A SHORT GEOLOGICAL HISTORY OF BLOCK ISLAND AND RHODE ISLAND SOUNDS

Ocean Special Area Management Plan

6 January 2009

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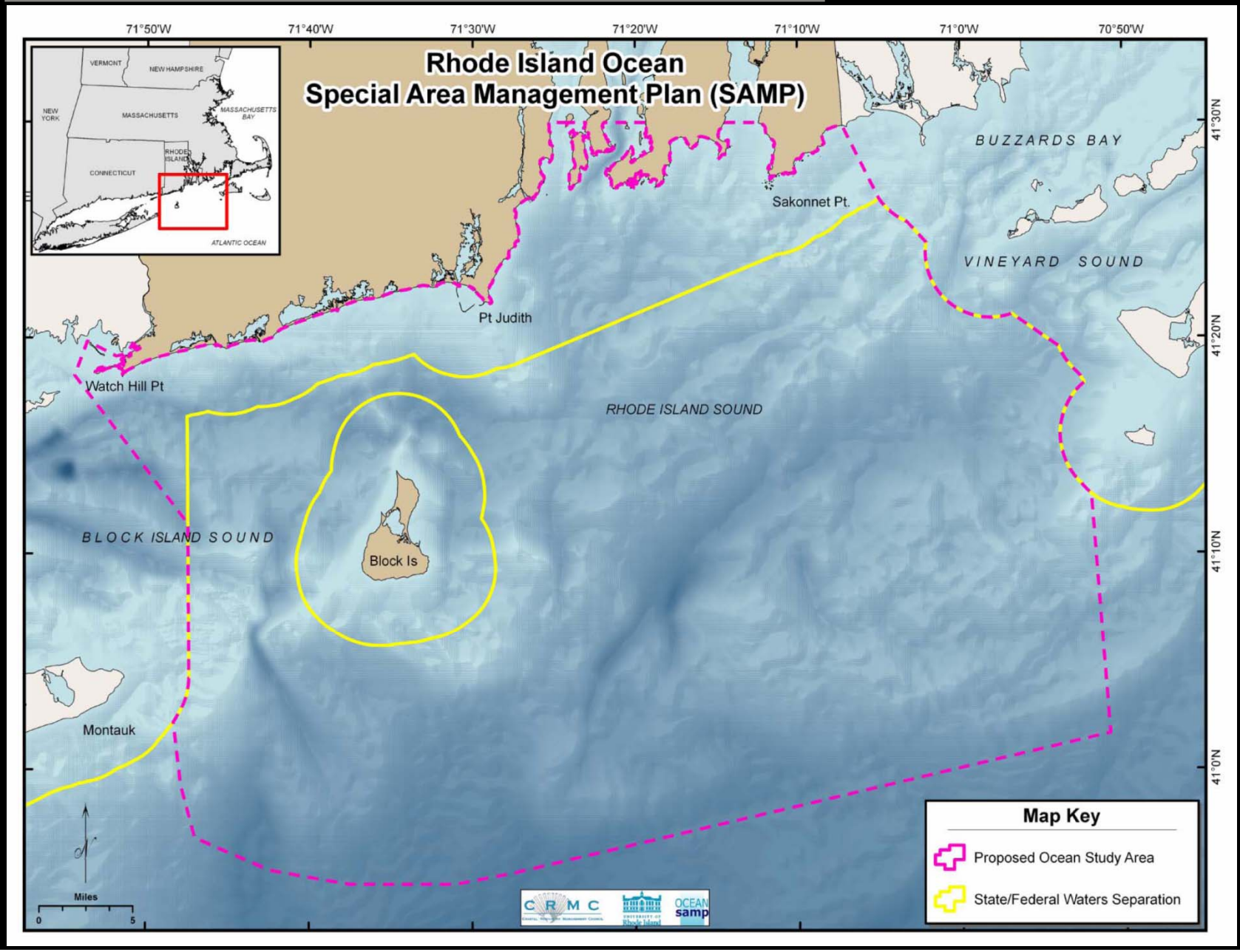
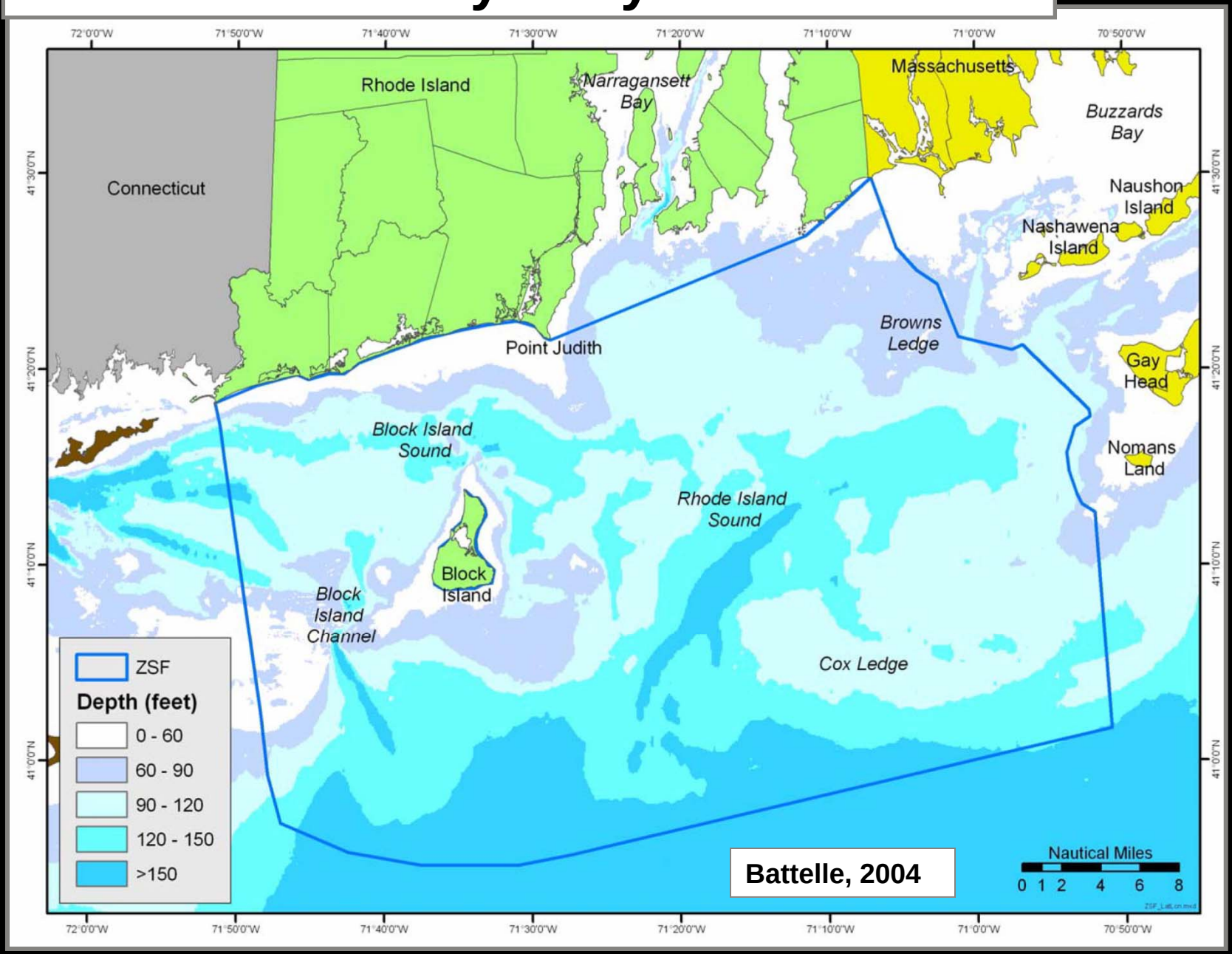
Ocean SAMP Boundary



Generalized Bathymetry – SAMP Area



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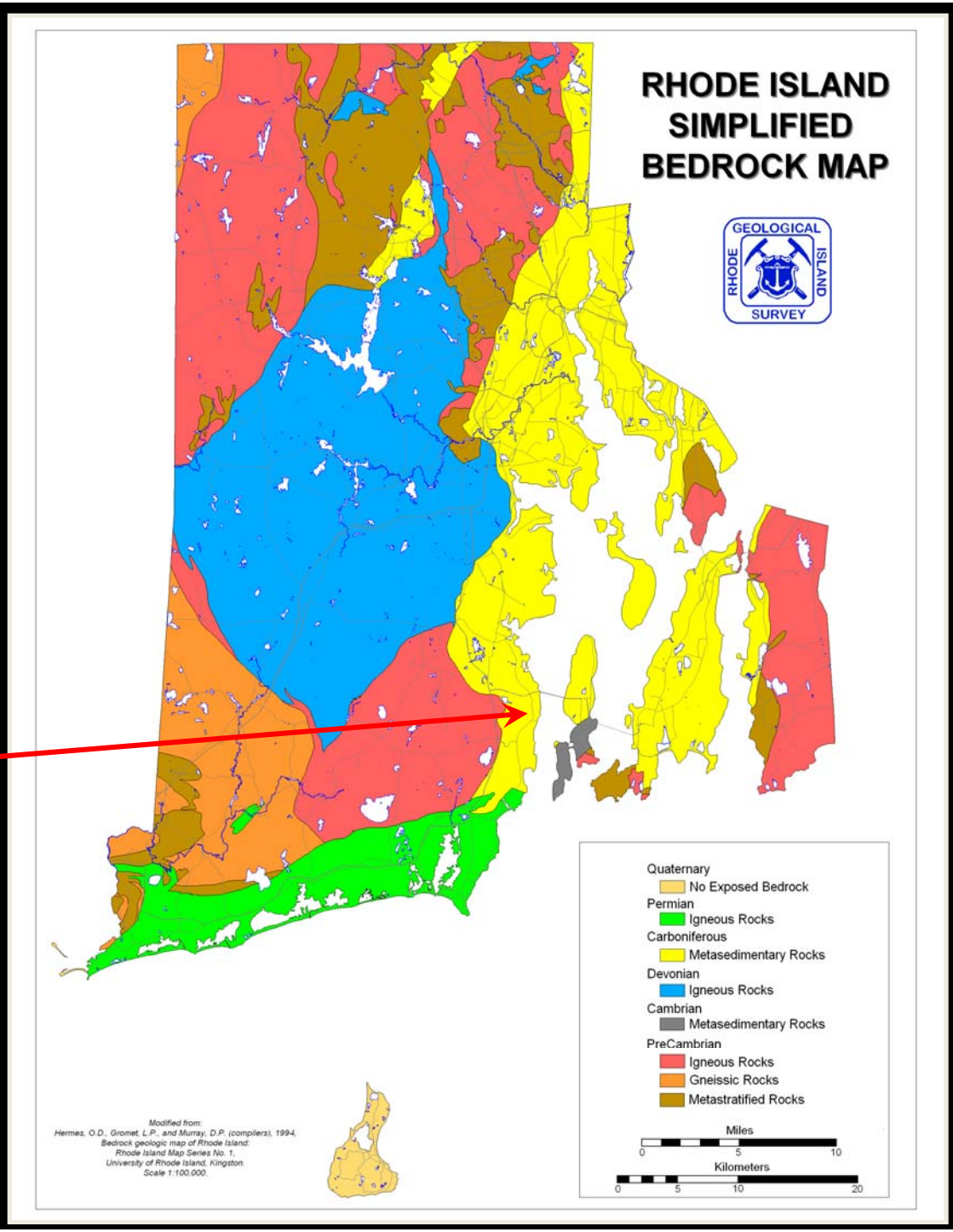
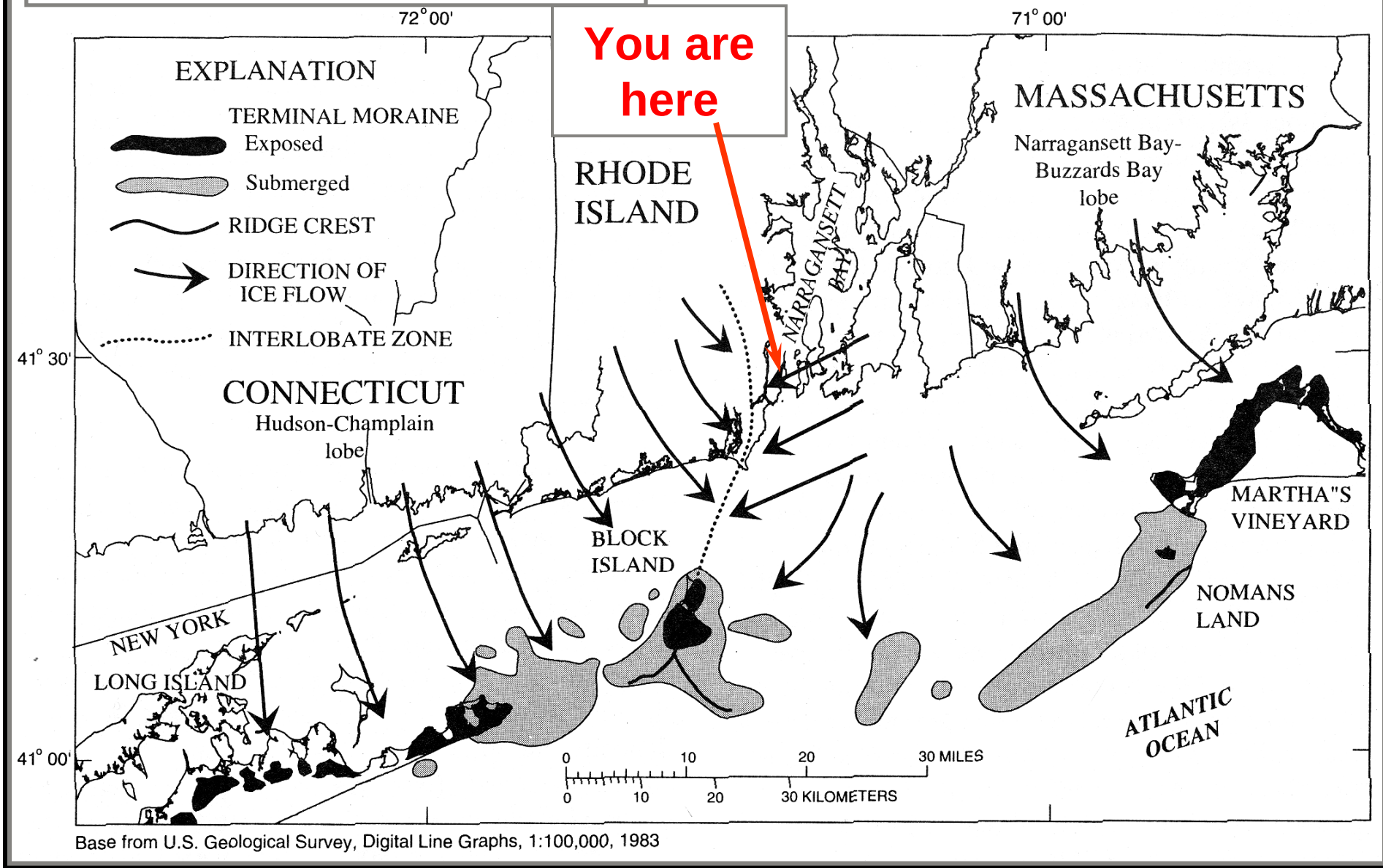

RHODE ISLAND
SIMPLIFIED
BEDROCK MAP
GEOLOGICAL
RHODE ISLAND
SURVEY
Quaternary
No Exposed Bedrock
Permian
Igneous Rocks
Carboniferous
Metasedimentary Rocks
Devonian
Igneous Rocks
Cambrian
Metasedimentary Rocks
PreCambrian
Igneous Rocks
Gneissic Rocks
Metastratified Rocks
Miles
0 5 10
Kilometers
0 5 10 20
Modified from:
Hermes, O.D., Gromet, L.P., and Murray, D.P. (compilers), 1994,
Bedrock geologic map of Rhode Island:
Rhode Island Map Series No. 1,
University of Rhode Island, Kingston.
Scale 1:100,000.

MALASPINA GLACIER – Northeast Gulf of Alaska

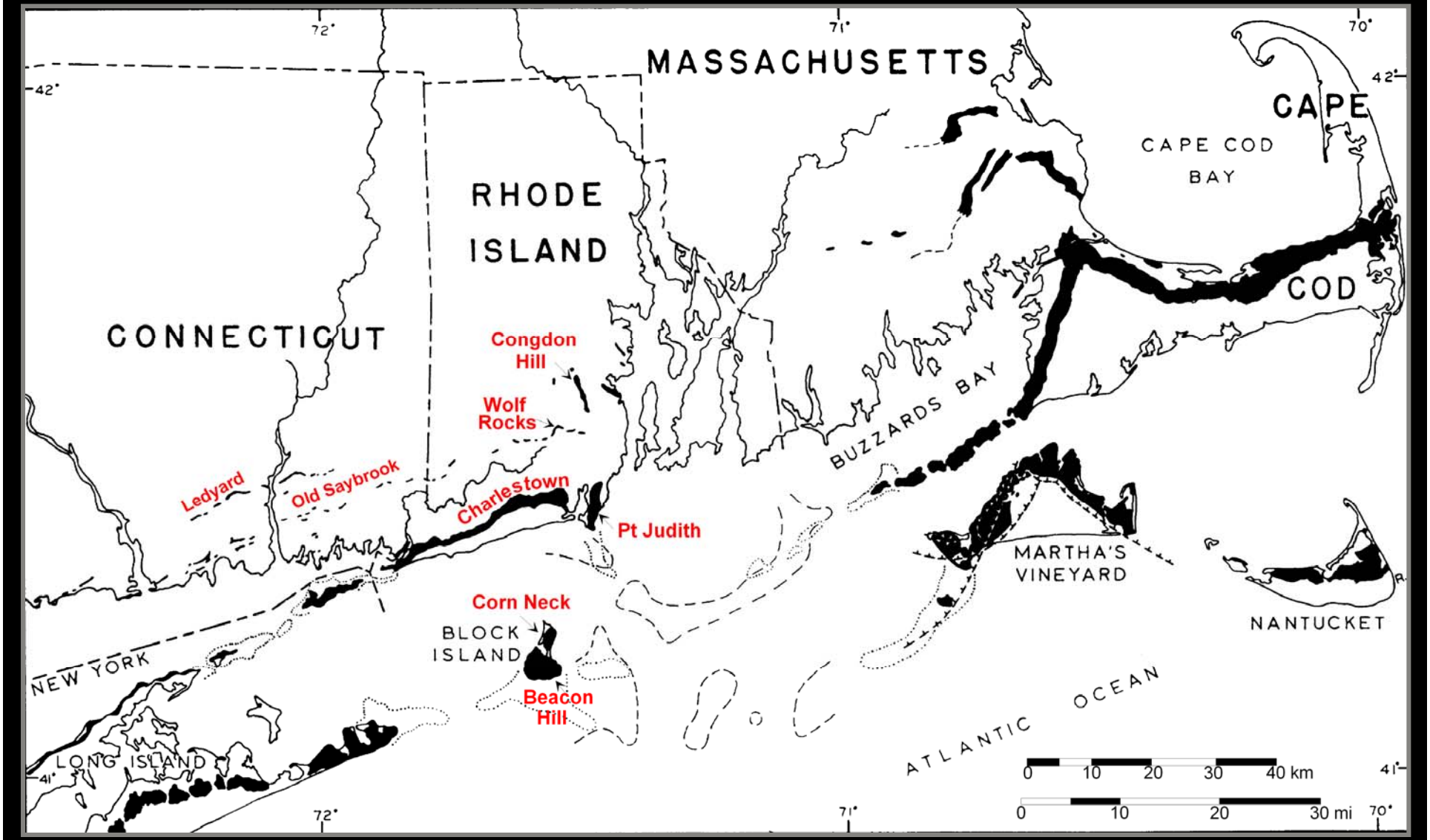
An Analog "The size of Rhode Island"

Ice Flow Directions



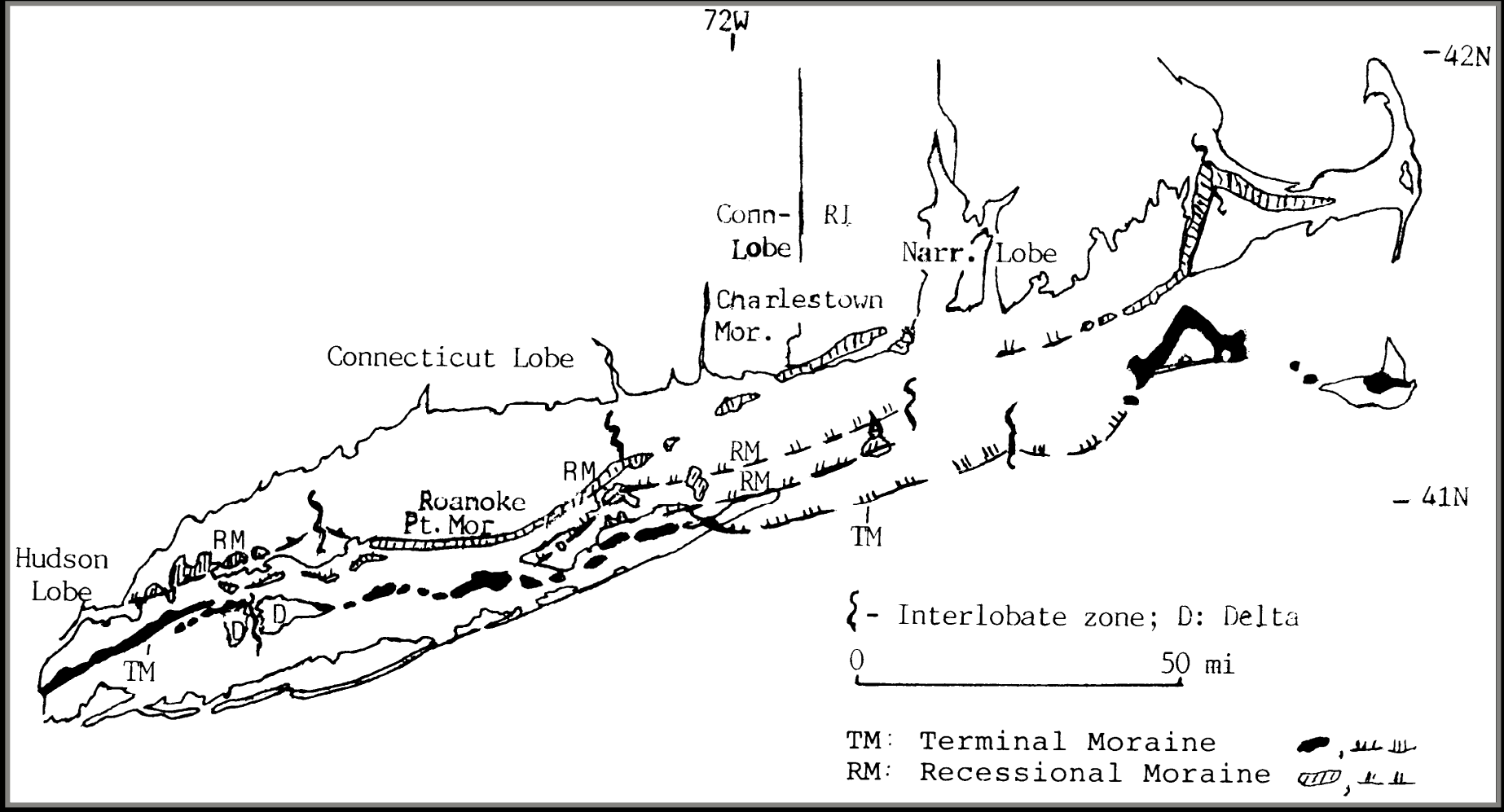
Stone and Sirkin, 1996

End Moraines of Southeastern New England

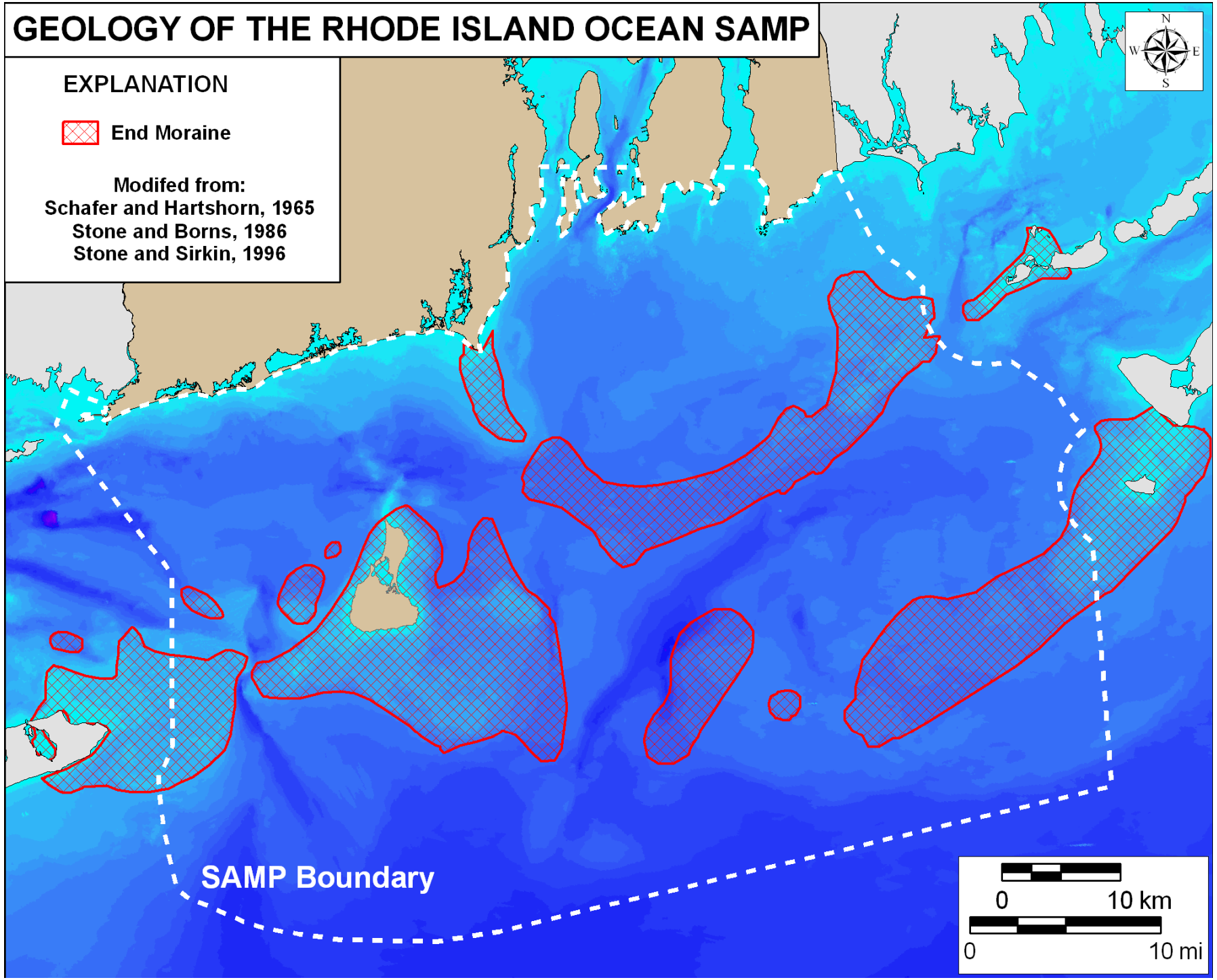


Schafer and Hartshorn, 1965; Goldsmith, 1982; Sirkin, 1982

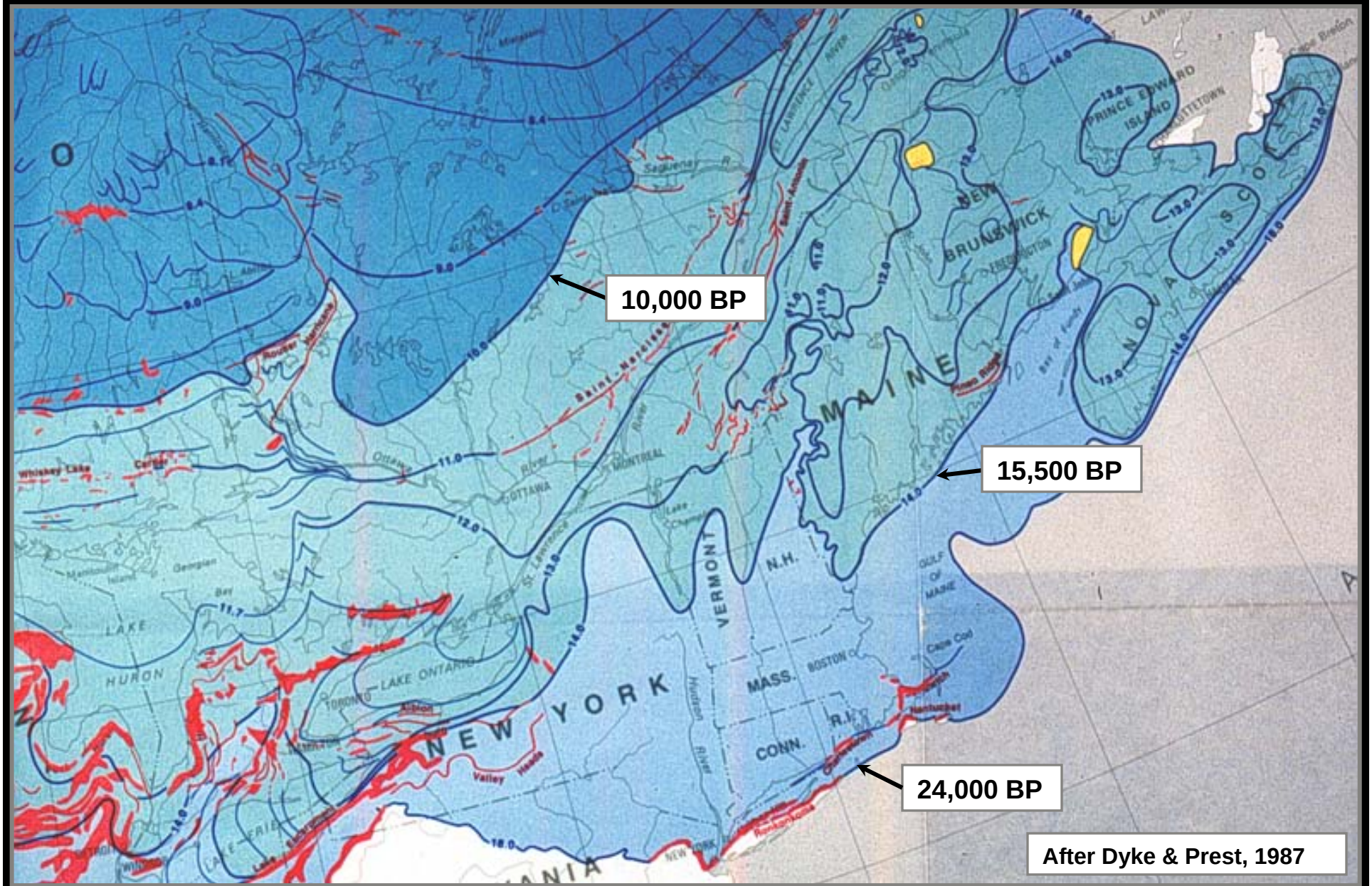
End Moraines of Southeastern New England and Long Island

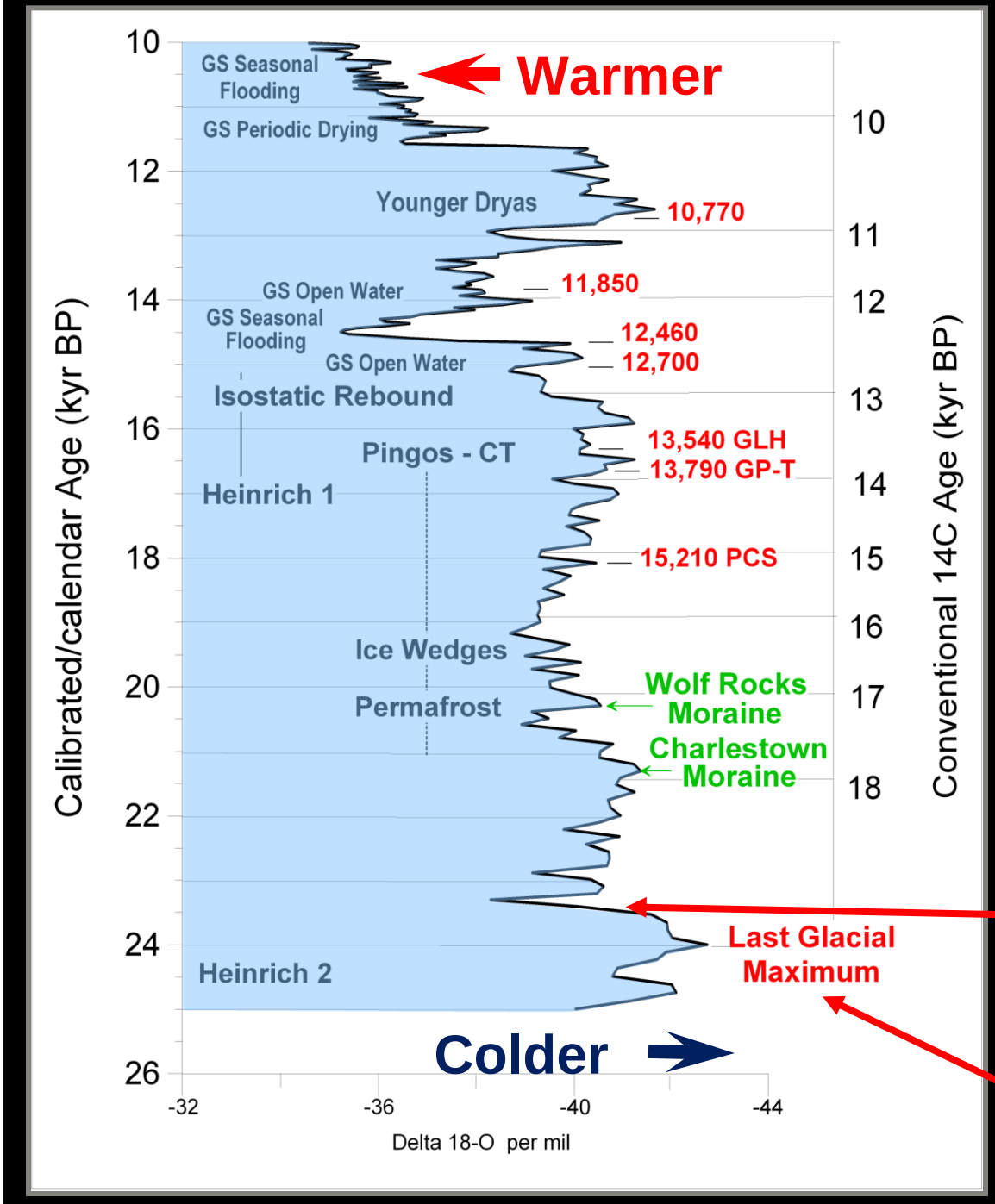


Sirkin, 1982, 1996


GEOLOGY OF THE RHODE ISLAND OCEAN SAMP
EXPLANATION
End Moraine
Modifed from:
Schafer and Hartshorn, 1965
Stone and Borns, 1986
Stone and Sirkin, 1996
N
W
E
S
SAMP Boundary
0
10 km
0
10 mi

Laurentide Ice Retreat





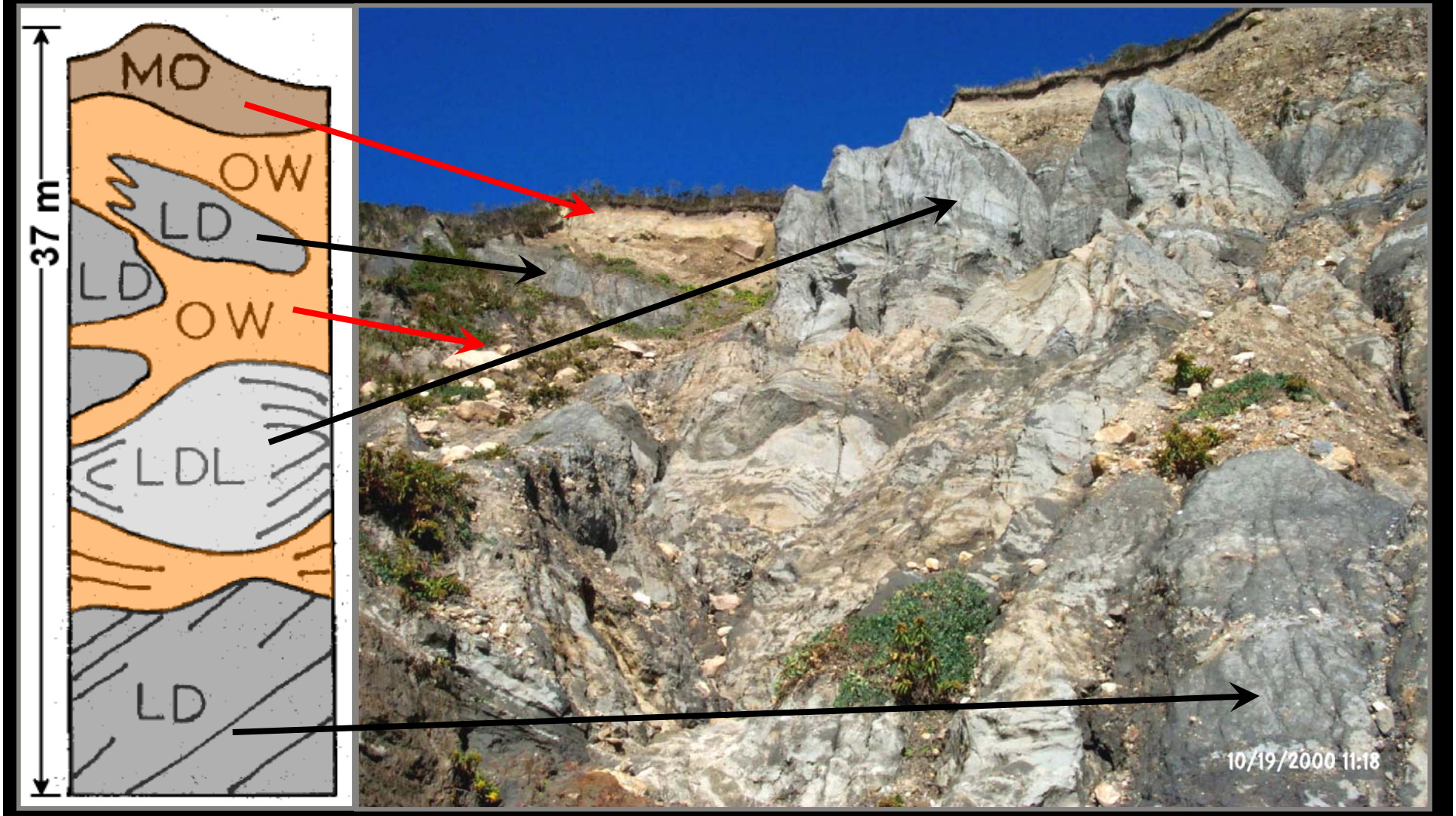
Events in Southern RI Correlated to Greenland GISP-2 Ice Core

Ice Retreating from Block Island

Block Island Ice Covered

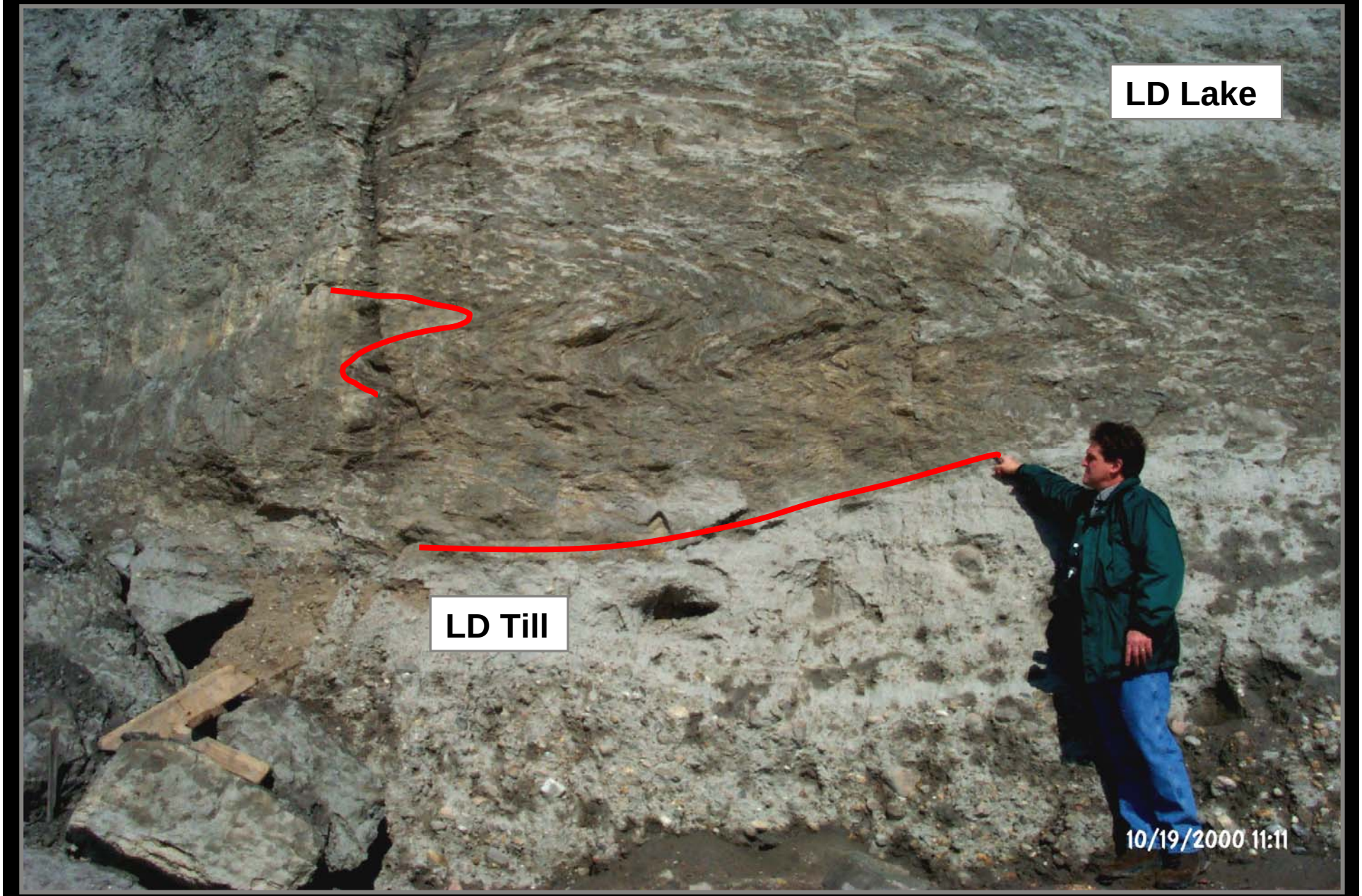
Mohegan Bluffs, BI – Complex Stratigraphy

Mohegan Bluffs, BI – Complex Stratigraphy

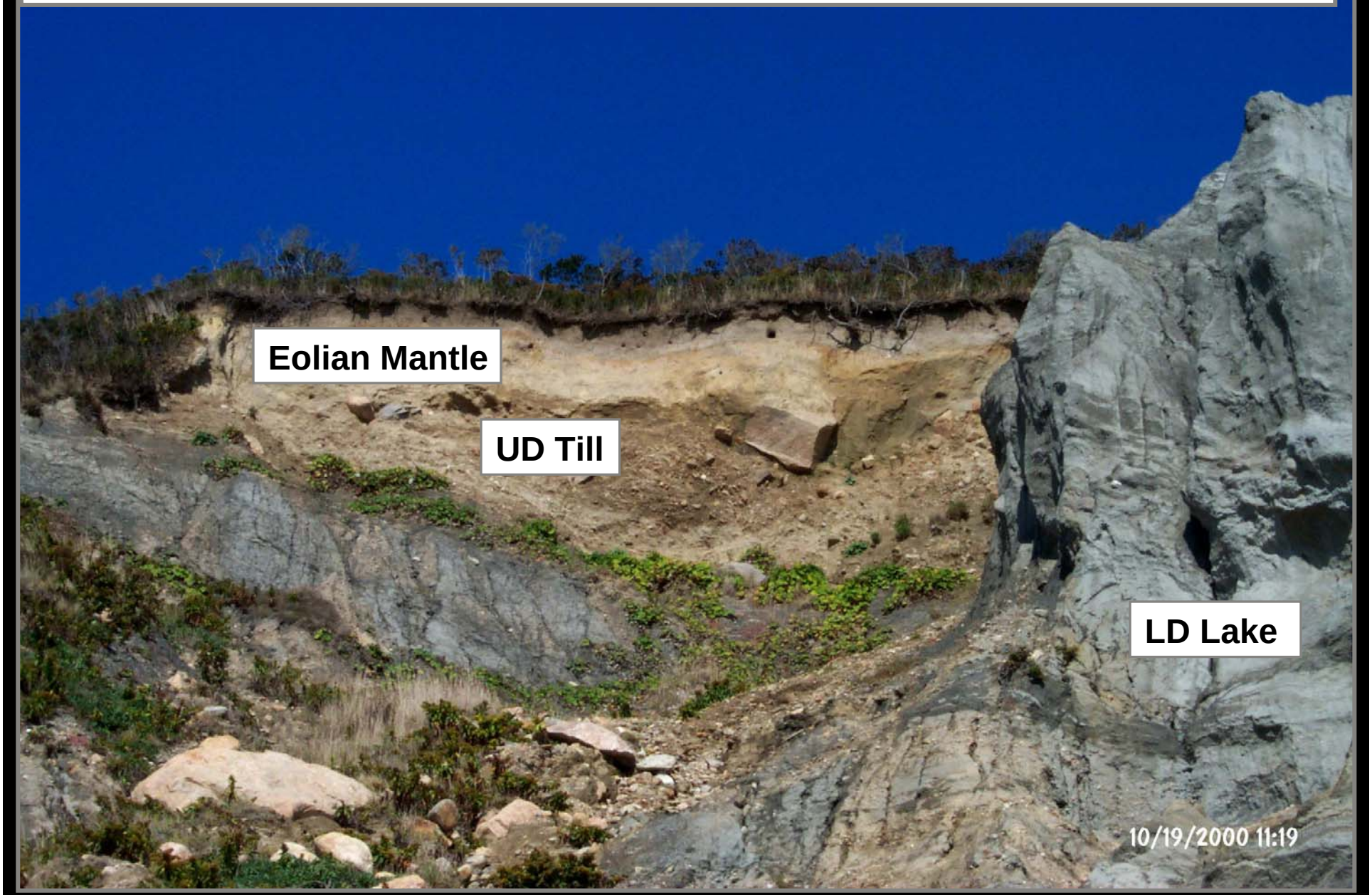


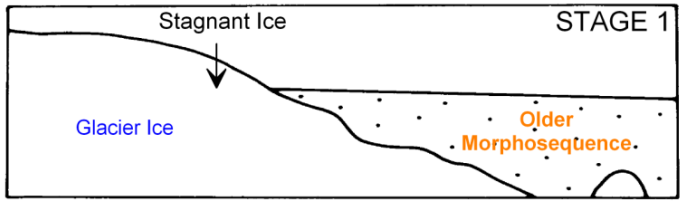
Boothroyd and Sirkin, 2002

Mohegan Bluffs, BI – Complex Stratigraphy

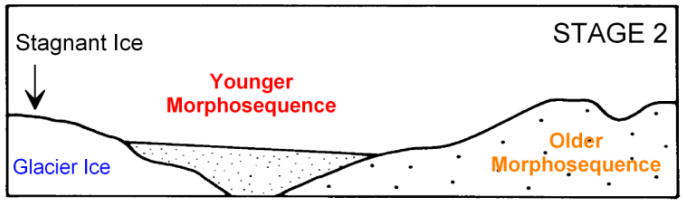


Mohegan Bluffs, BI – Complex Stratigraphy

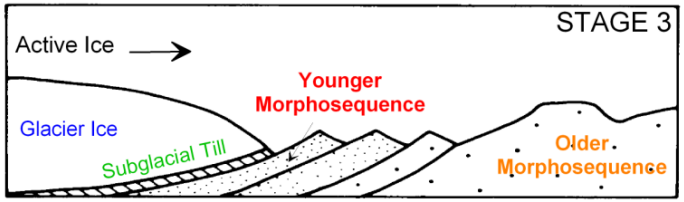




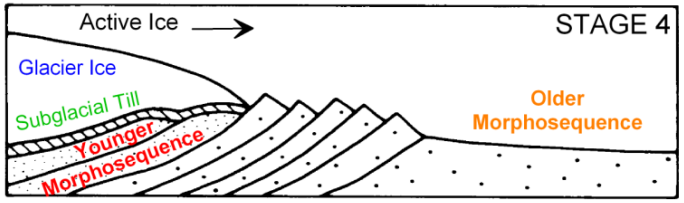
Proglacial Fluvial and Lacustrine Deposition (Older)



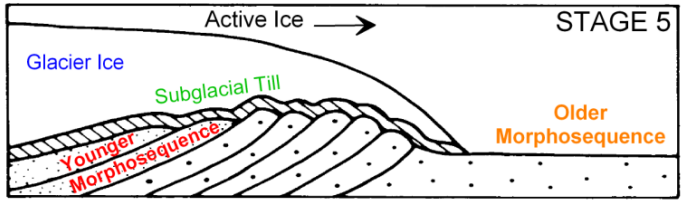
Proglacial Fluvial and Lacustrine Deposition (Younger)



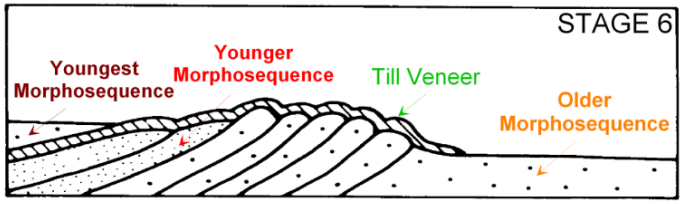
Formation of End Moraine Thrust Sheets (I - Older to left)



Formation of End MoraineThrust Sheets (II - Younger to right)



Overiding of Moraine Thrust Sheets and Deposition of Till Veneer



Ice Retreat and Proglacial Fluvial and Lacustrine Deposition

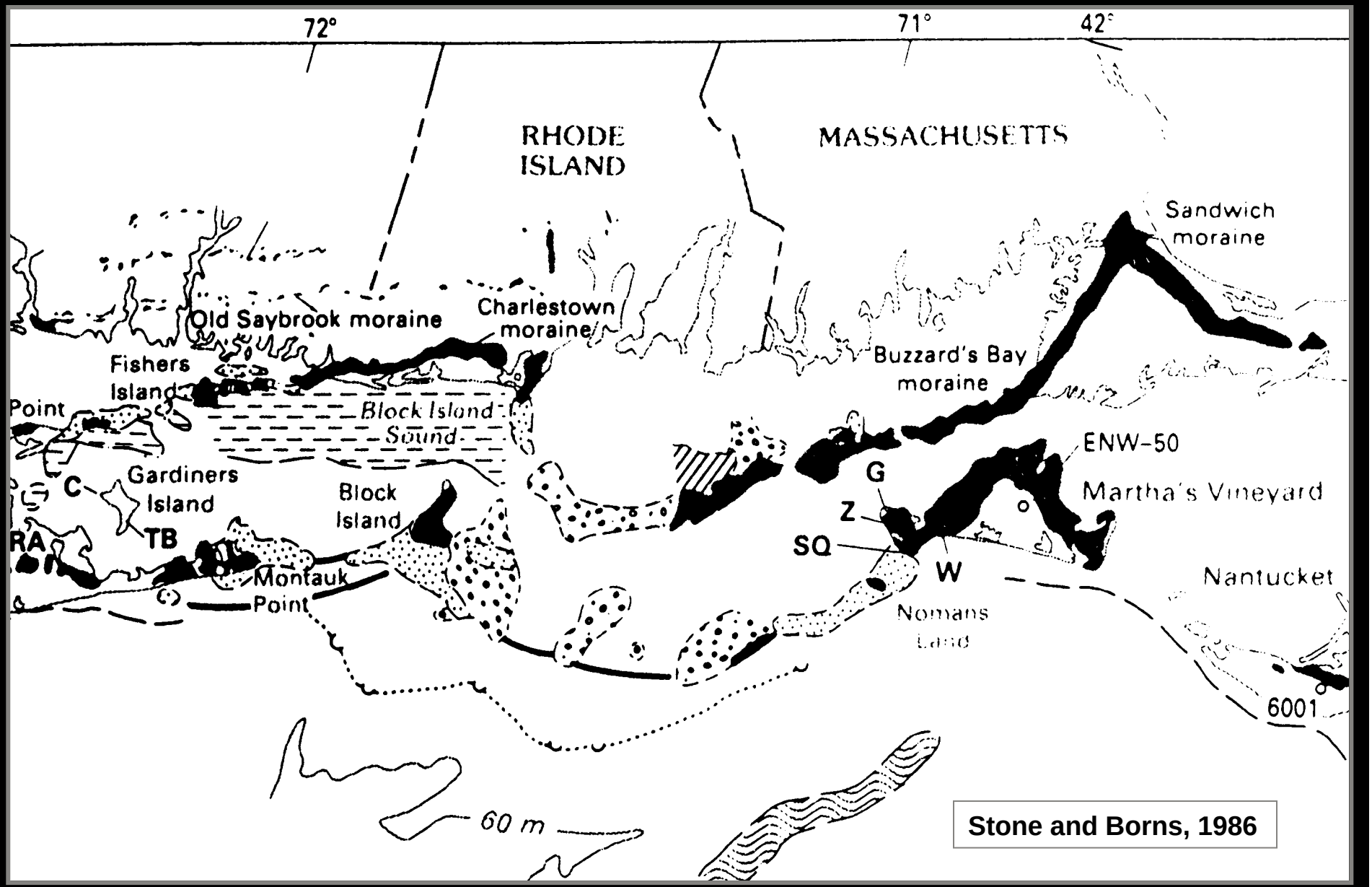
Tectonic End Moraines

Southern New England

Oldale and O'Hara, 1984

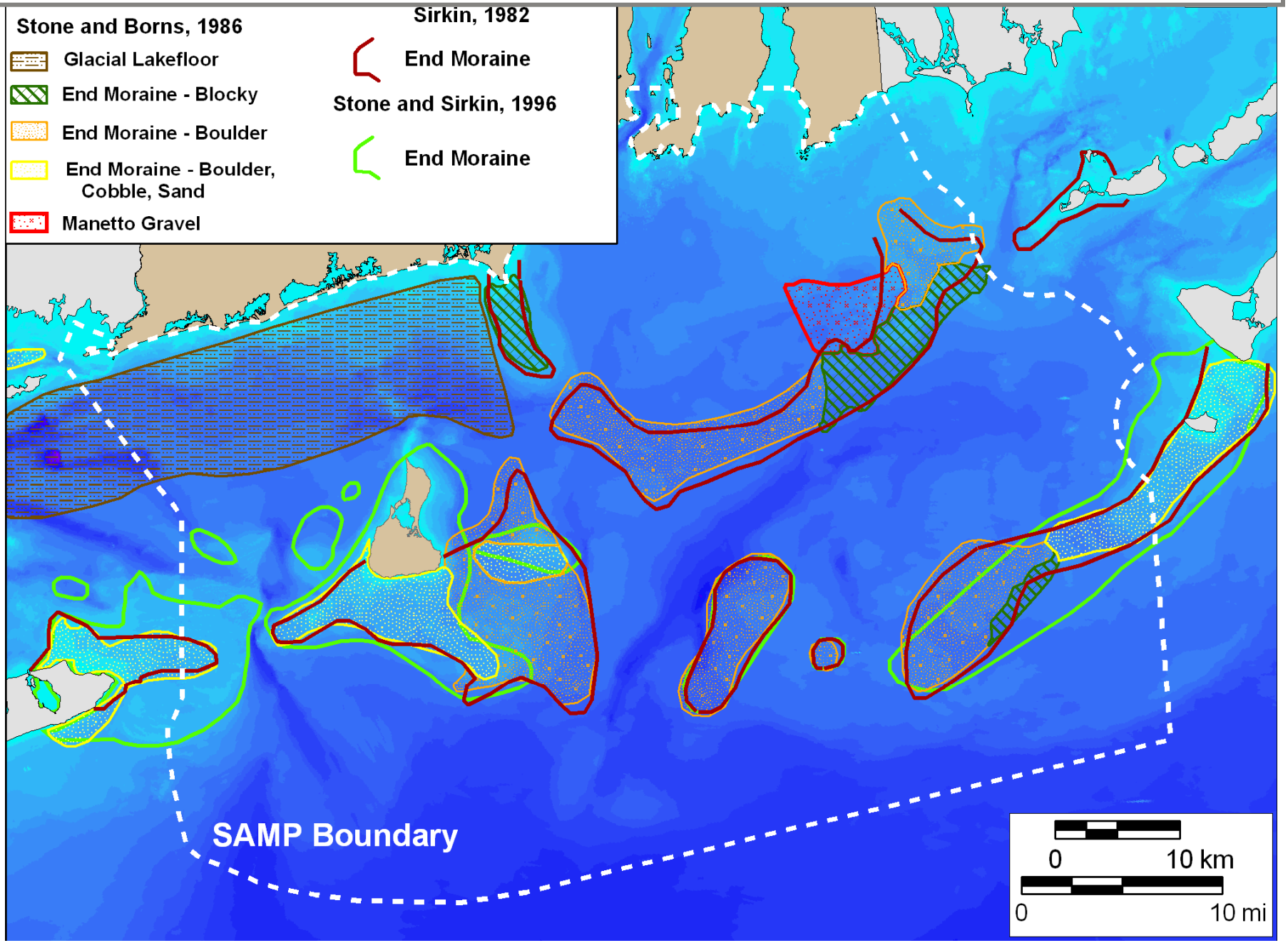
Eastern Shore, BI – Moraine Thrust Slices

Deglacial Configuration – BI and RI Sounds

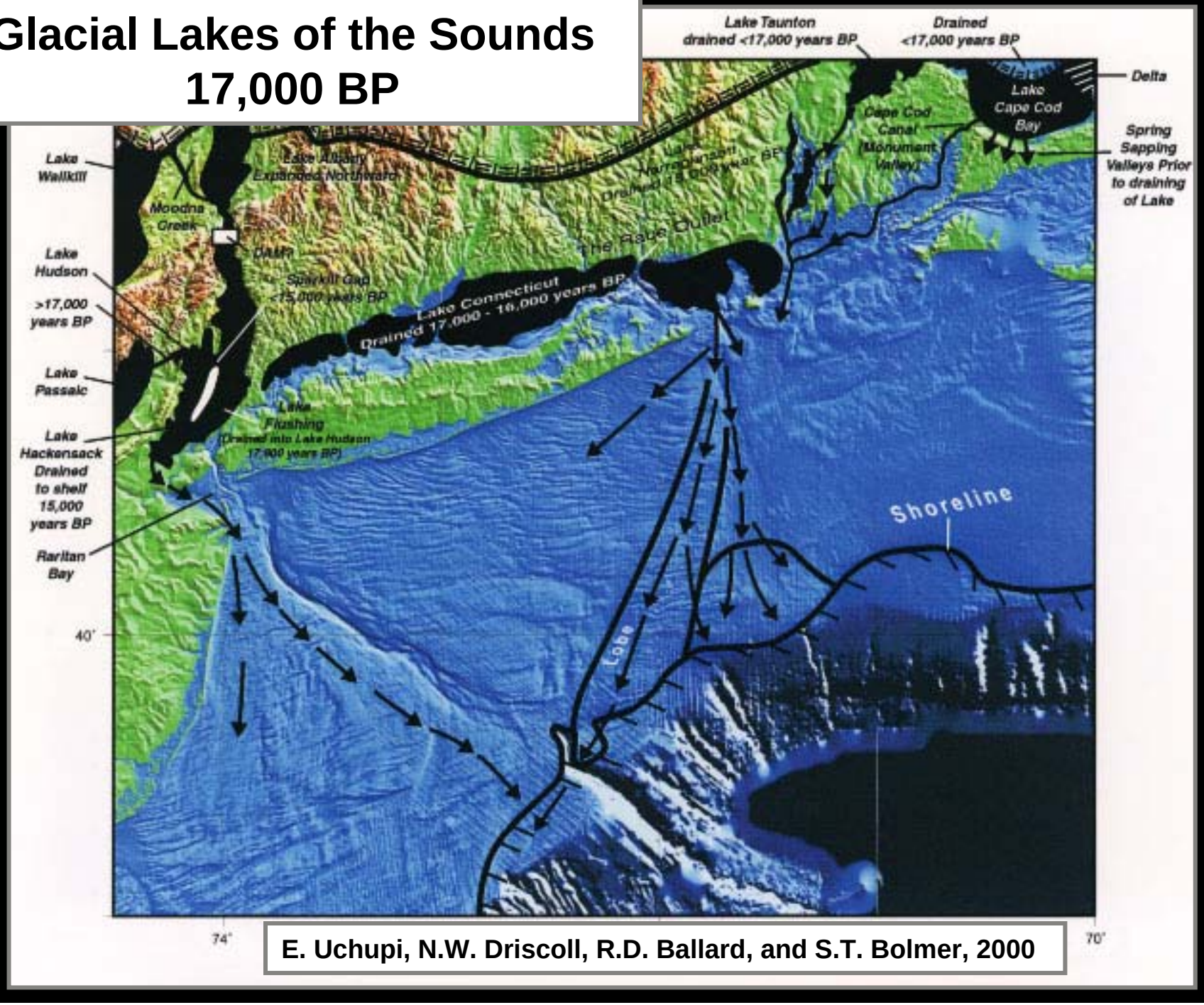


Stone and Borns, 1986

Deglacial Configuration – BI and RI Sounds

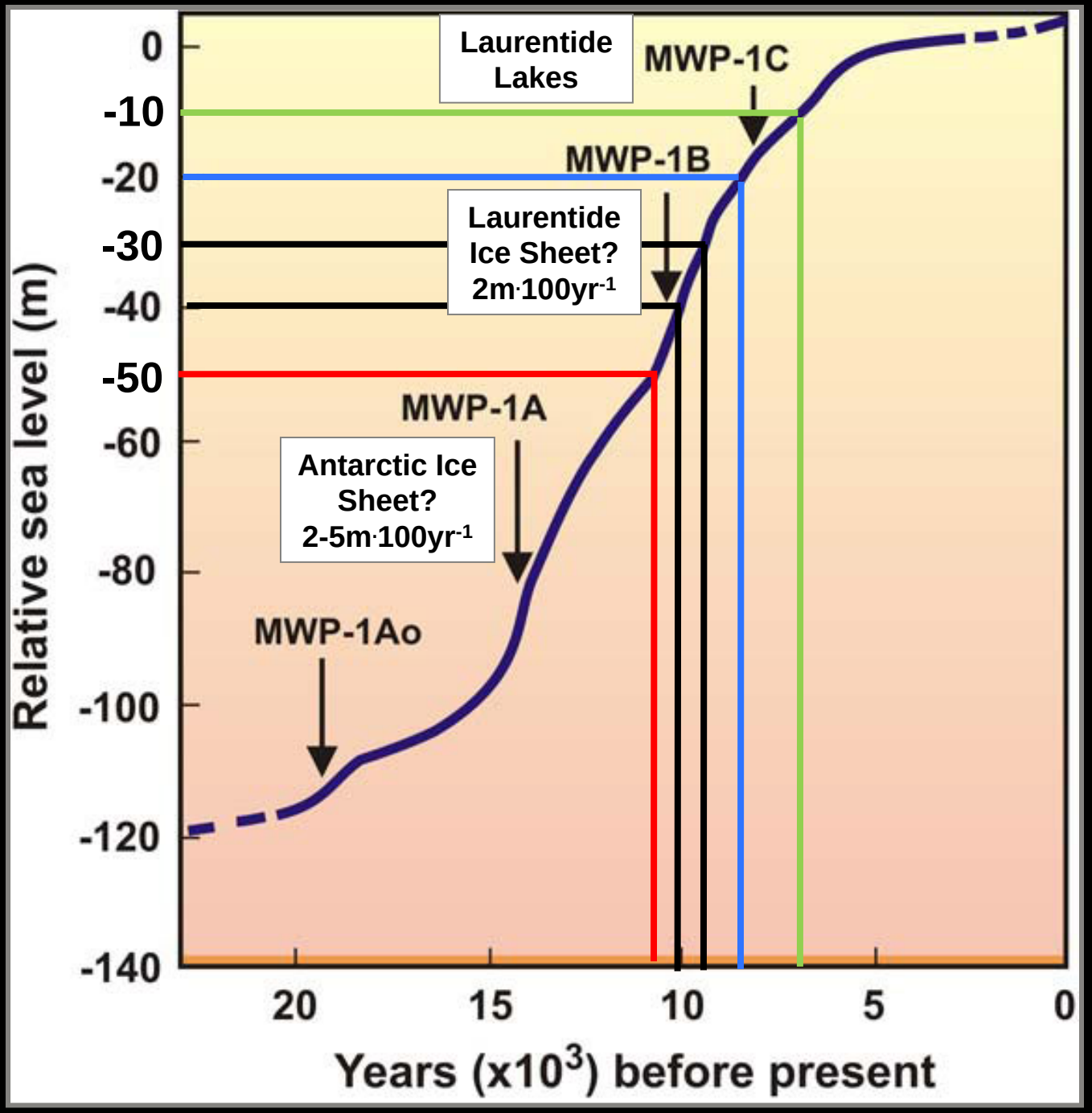


Glacial Lakes of the Sounds
17,000 BP



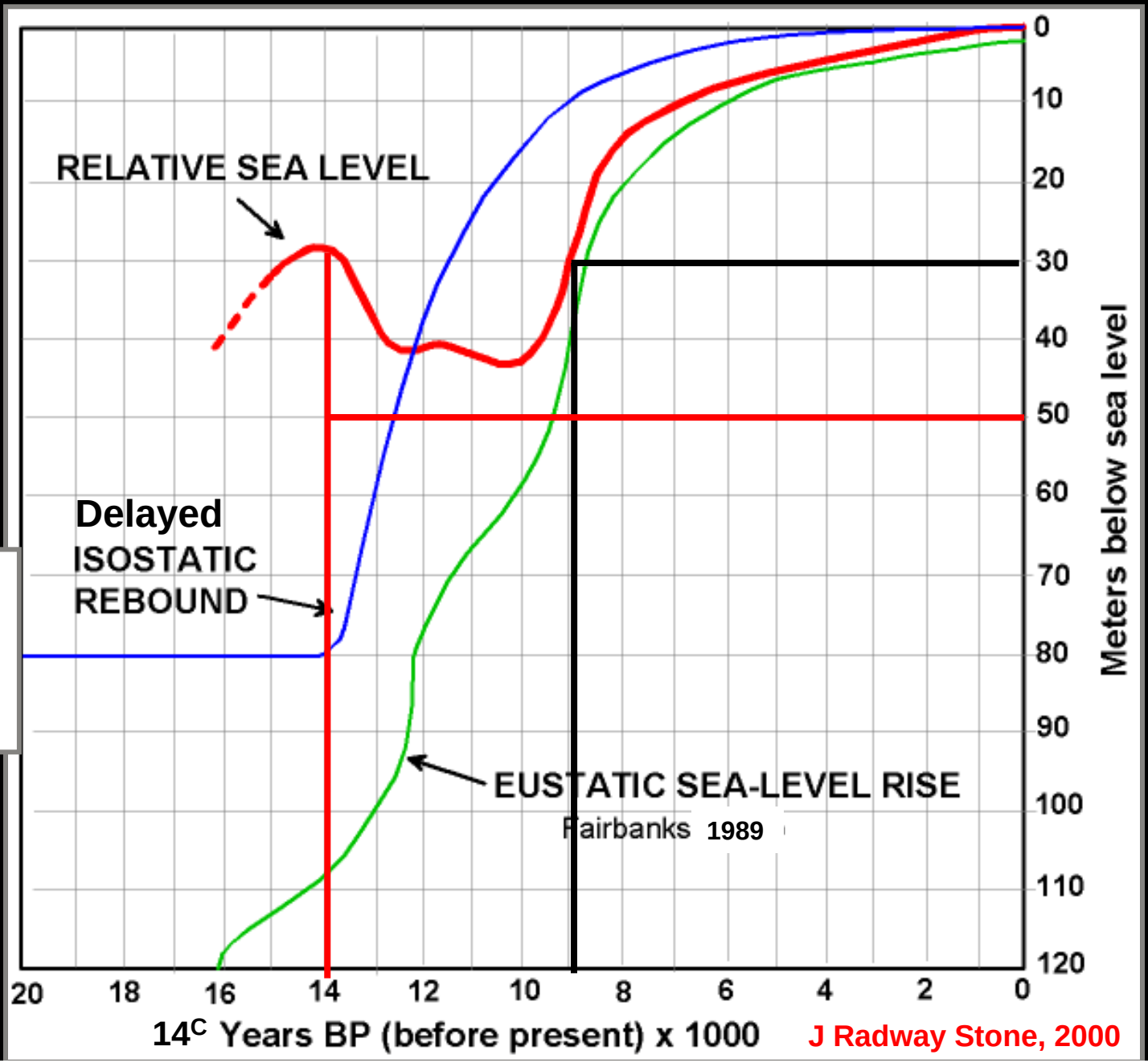
E. Uchupi, N.W. Driscoll, R.D. Ballard, and S.T. Bolmer, 2000

Eustatic Sea-Level Rise

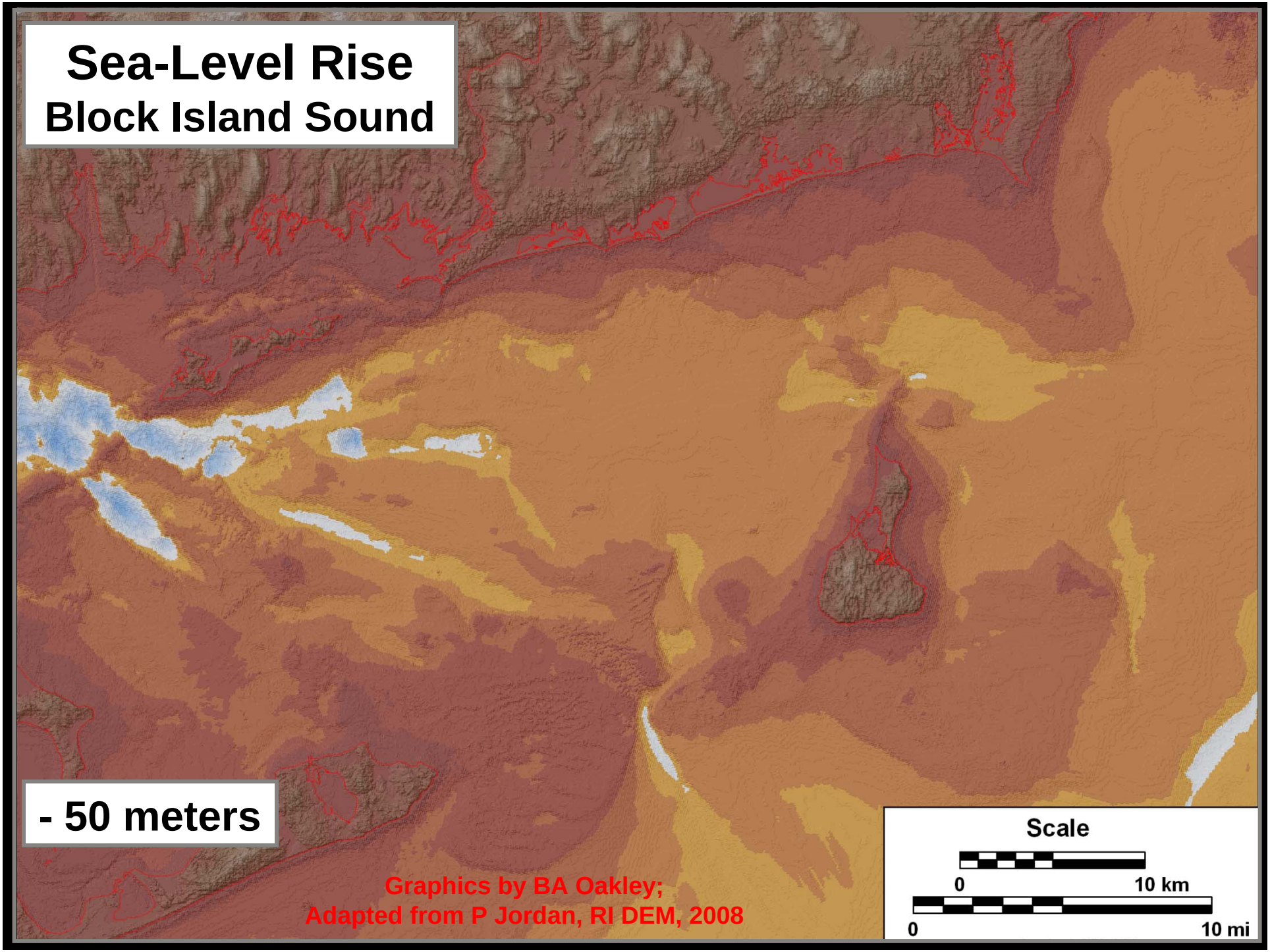


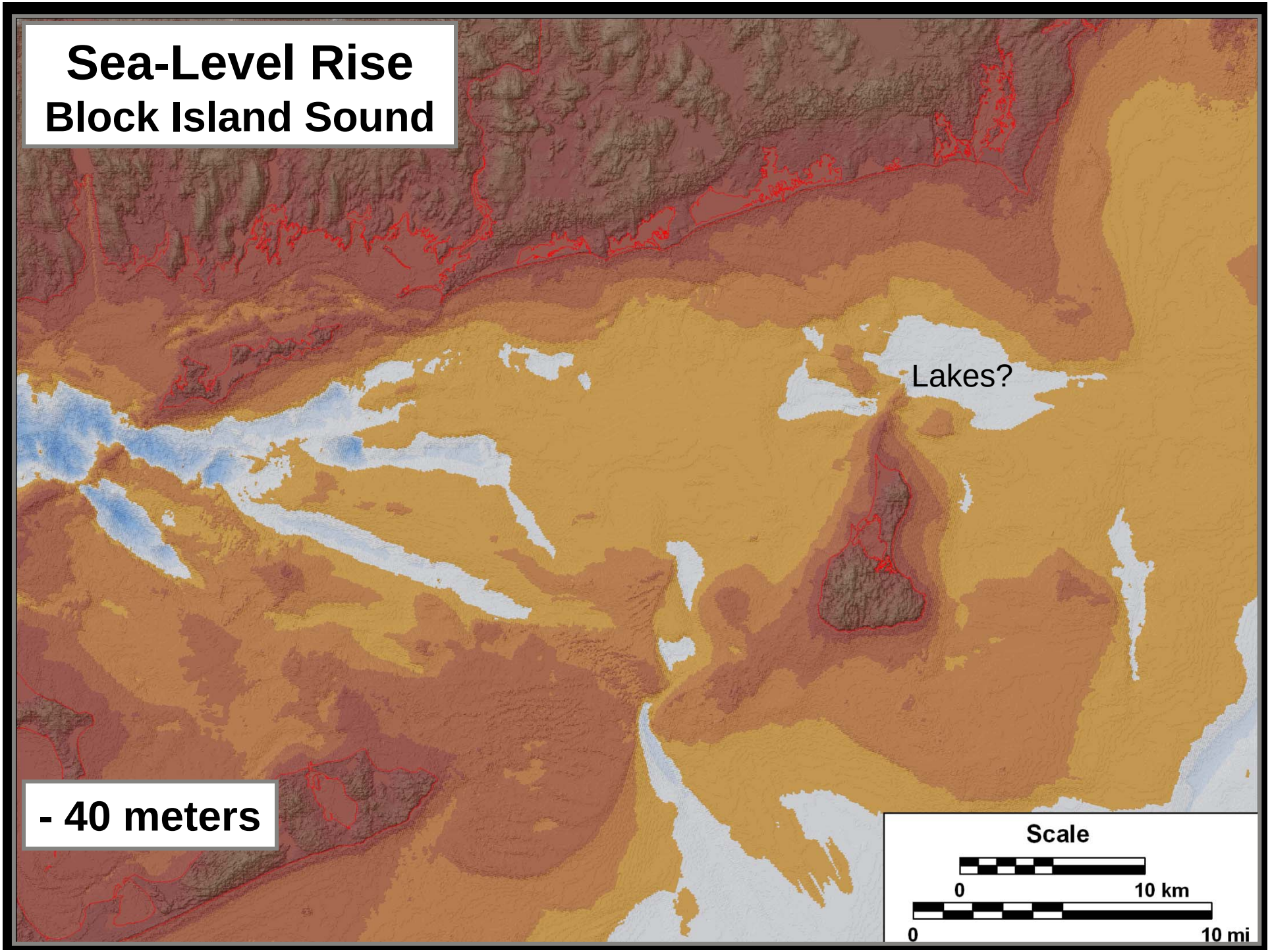
Fairbanks, 1989

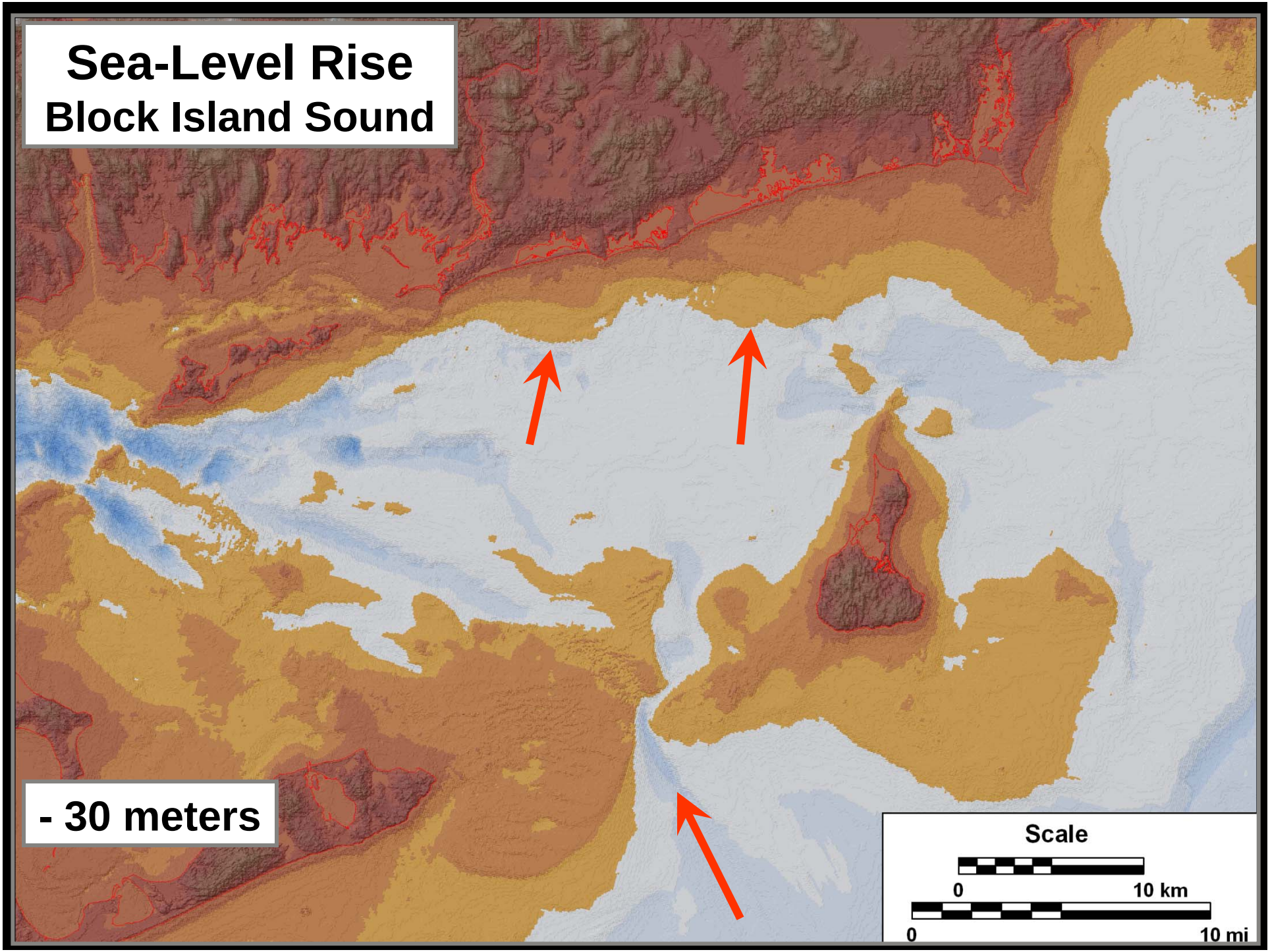
RELATIVE CRUSTAL MOTION Central Long Island Sound

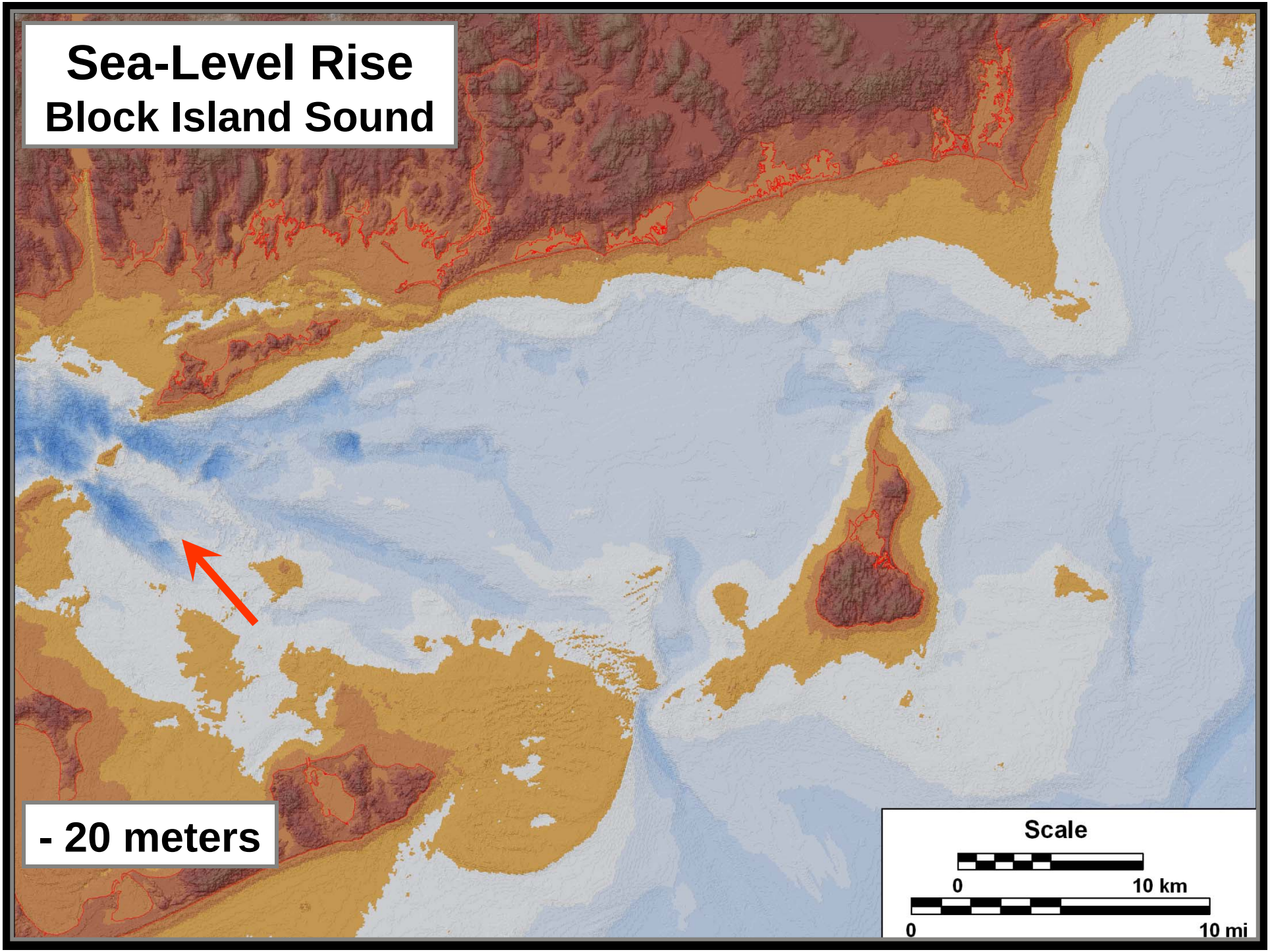


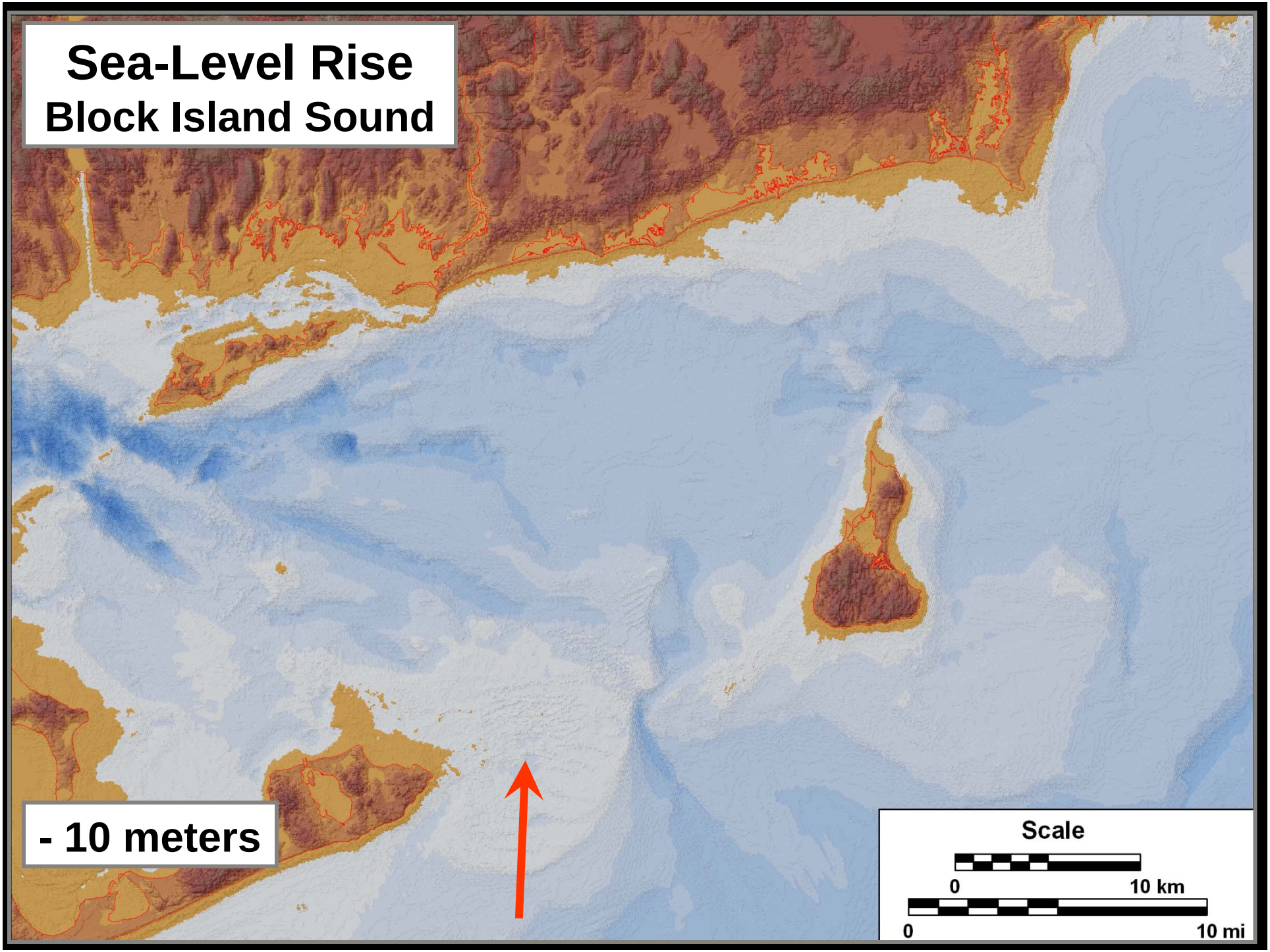
Not 80m at BI

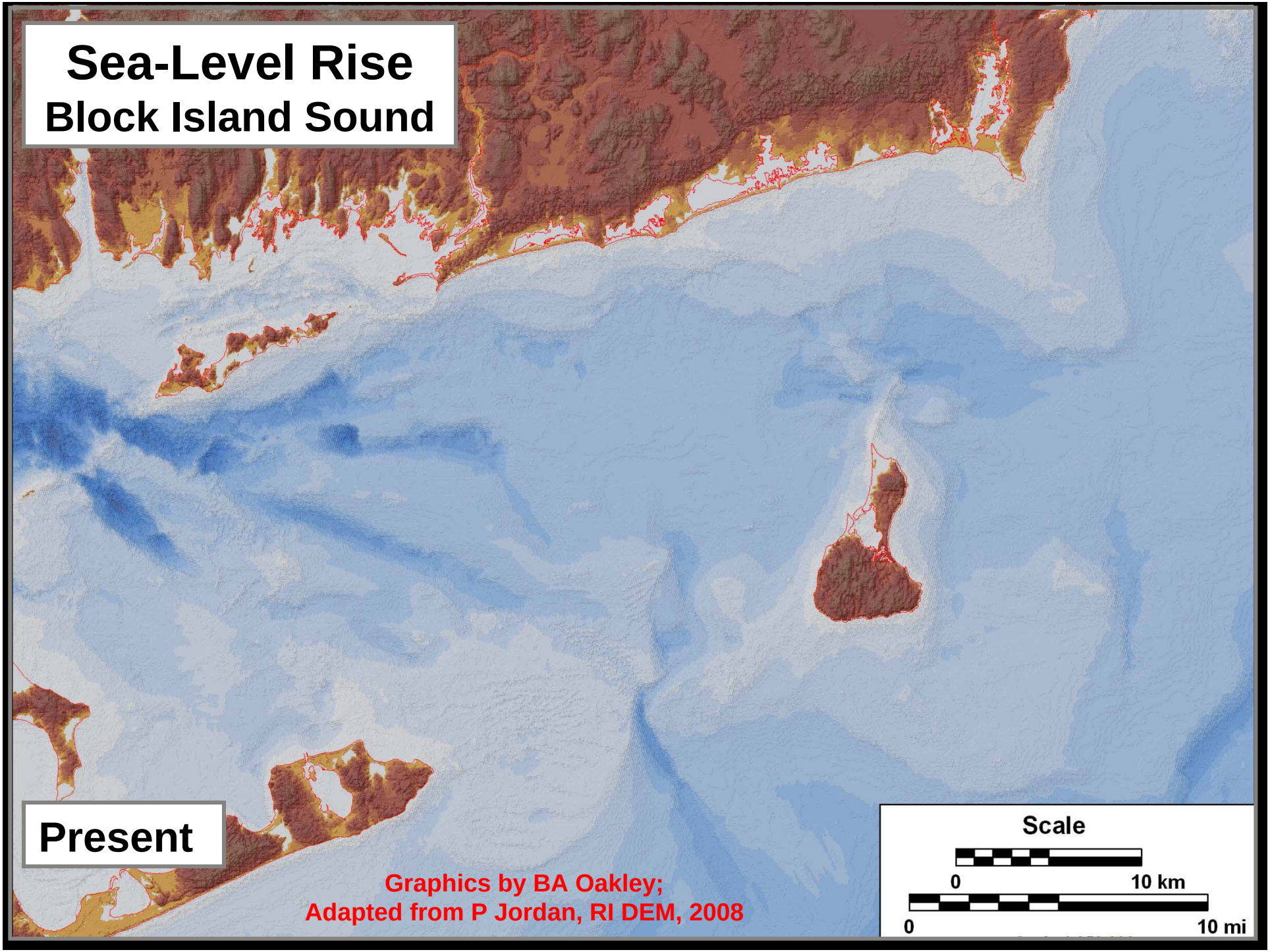

Sea-Level Rise
Block Island Sound
- 50 meters
Graphics by BA Oakley;
Adapted from P Jordan, RI DEM, 2008
Scale
0
10 km
0
10 mi


Sea-Level Rise
Block Island Sound
Lakes?
- 40 meters
Scale
0
10 km
0
10 mi


Sea-Level Rise
Block Island Sound
- 30 meters
Scale
0
10 km
0
10 mi

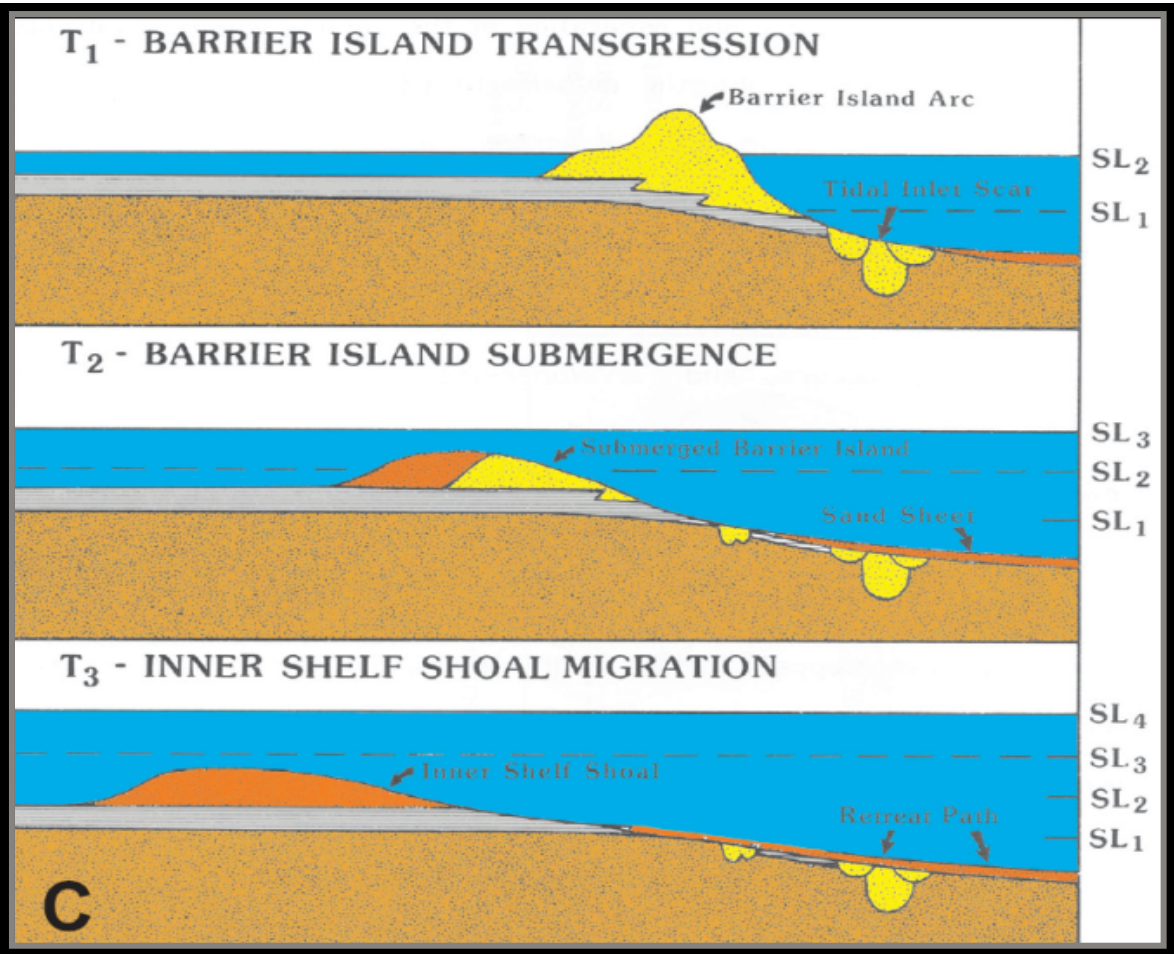

Sea-Level Rise
Block Island Sound
- 20 meters
Scale
0
10 km
0
10 mi

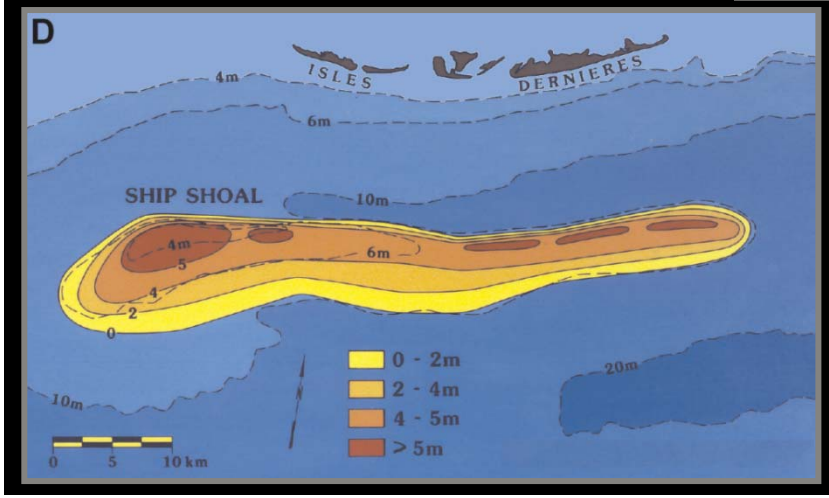

Sea-Level Rise
Block Island Sound
- 10 meters
Scale
0
10 km
0
10 mi


Sea-Level Rise
Block Island Sound
Present
Graphics by BA Oakley;
Adapted from P Jordan, RI DEM, 2008
Scale
0
10 km
0
10 mi

Shoreface Sediment Transport

Barrier Island Transition to Shelf Shoal





Penland, Suter and Boyd 1988

BENTHIC GEOLOGIC HABITATS : MATUNUCK-GREEN HILL SHOREFACE

Jon C. Boothroyd, Bryan A. Oakley, Jon D. Alvarez

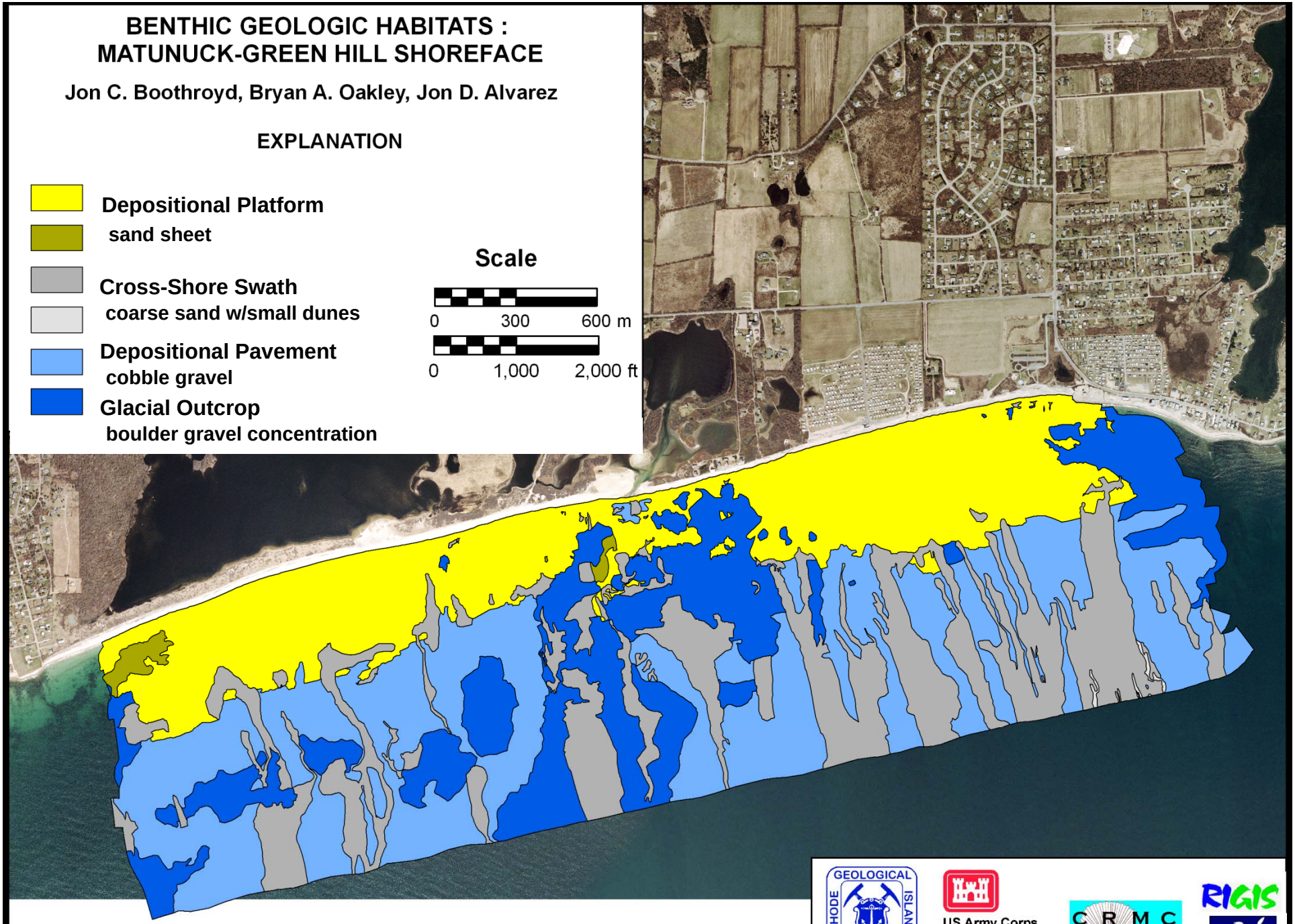
EXPLANATION

- **Depositional Platform**
  - sand sheet
- **Cross-Shore Swath**
  - coarse sand w/small dunes
- **Depositional Pavement**
  - cobble gravel
- **Glacial Outcrop**
  - boulder gravel concentration

Scale

0 300 600 m

0 1,000 2,000 ft



Draft: 30 Sept, 2006

RHODE ISLAND GEOLOGICAL SURVEY

US Army Corps of Engineers® New England District

CRMC Coastal Resources Management Council

RIGIS

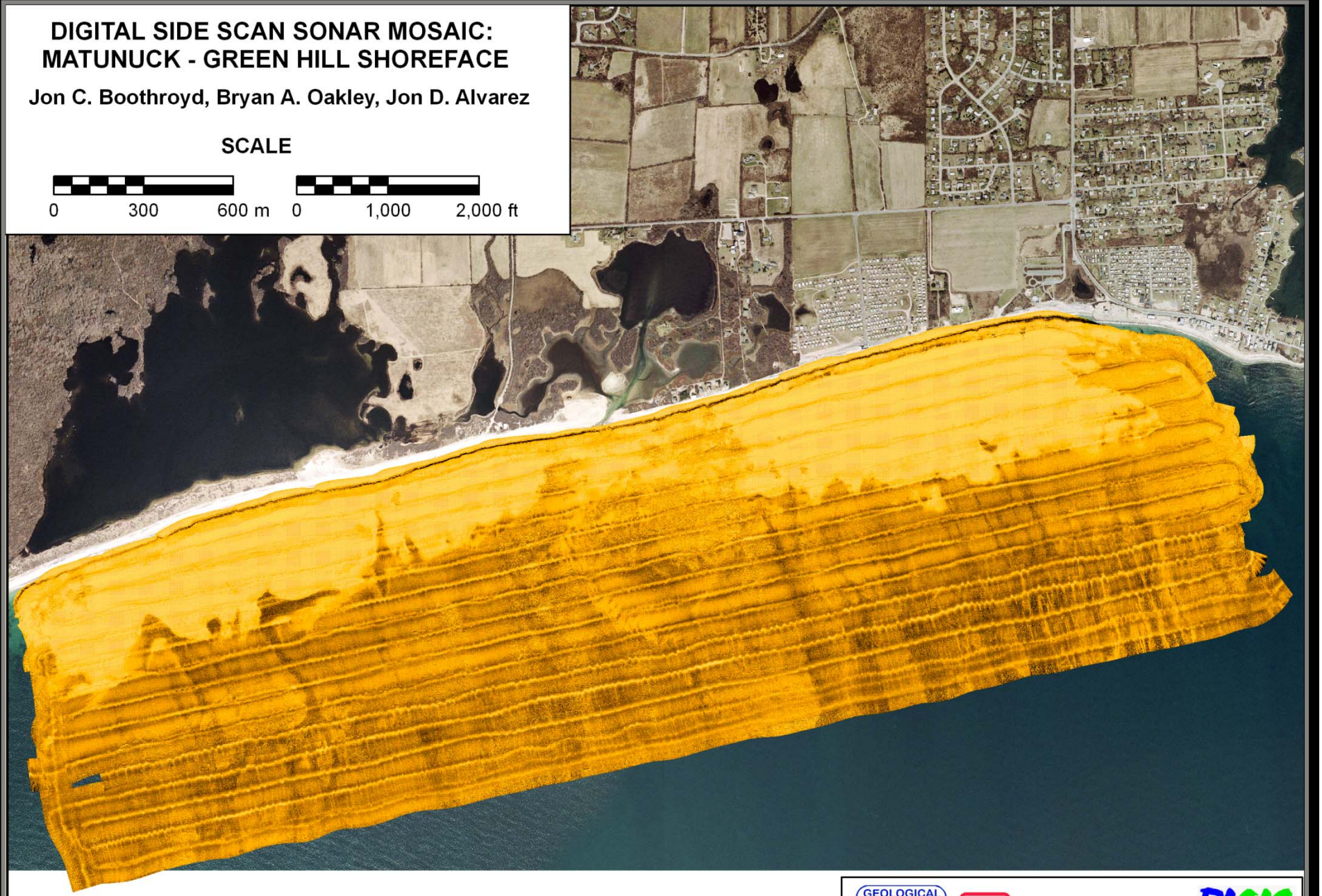
Sea Grant Rhode Island

DIGITAL SIDE SCAN SONAR MOSAIC: MATUNUCK - GREEN HILL SHOREFACE

Jon C. Boothroyd, Bryan A. Oakley, Jon D. Alvarez

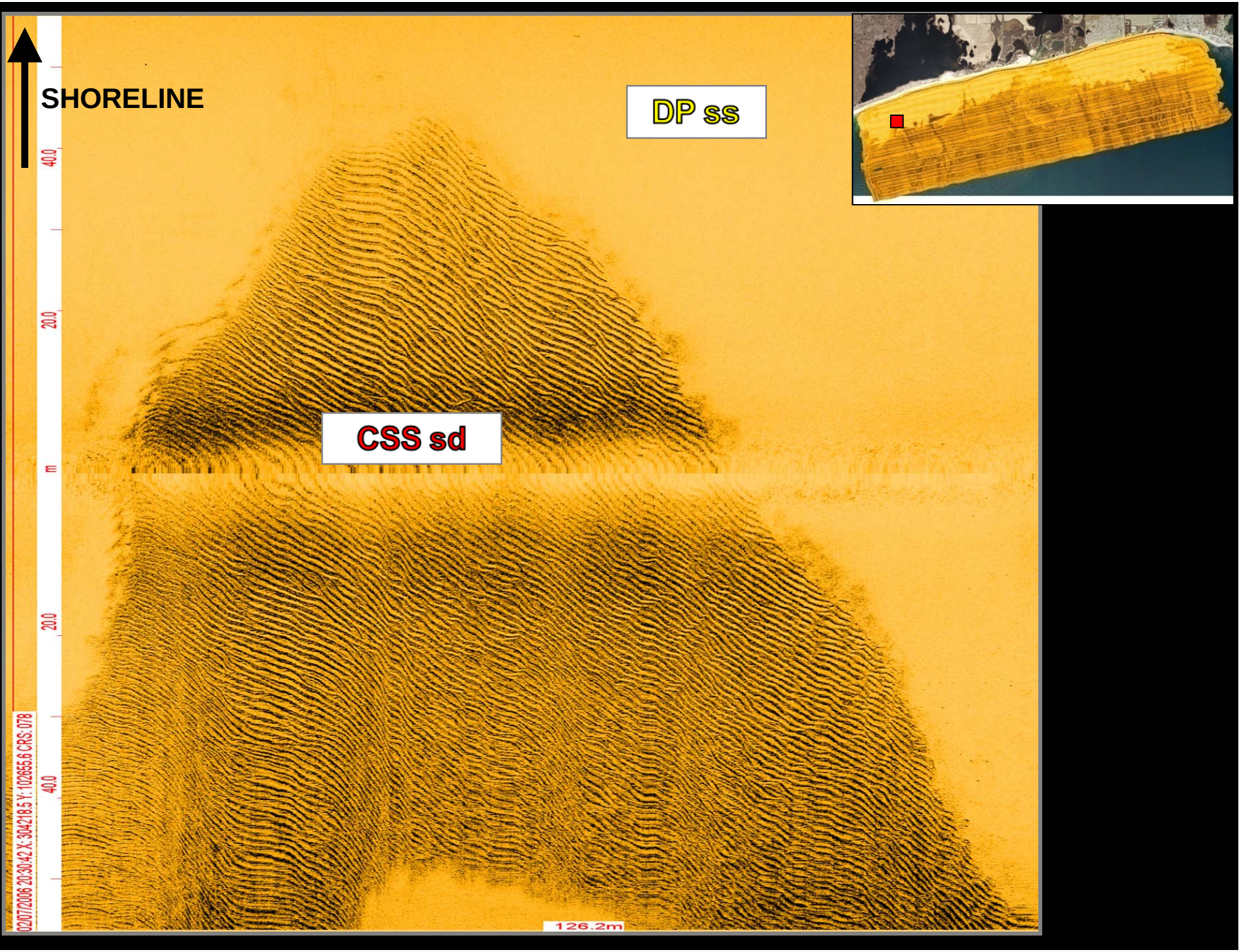
SCALE

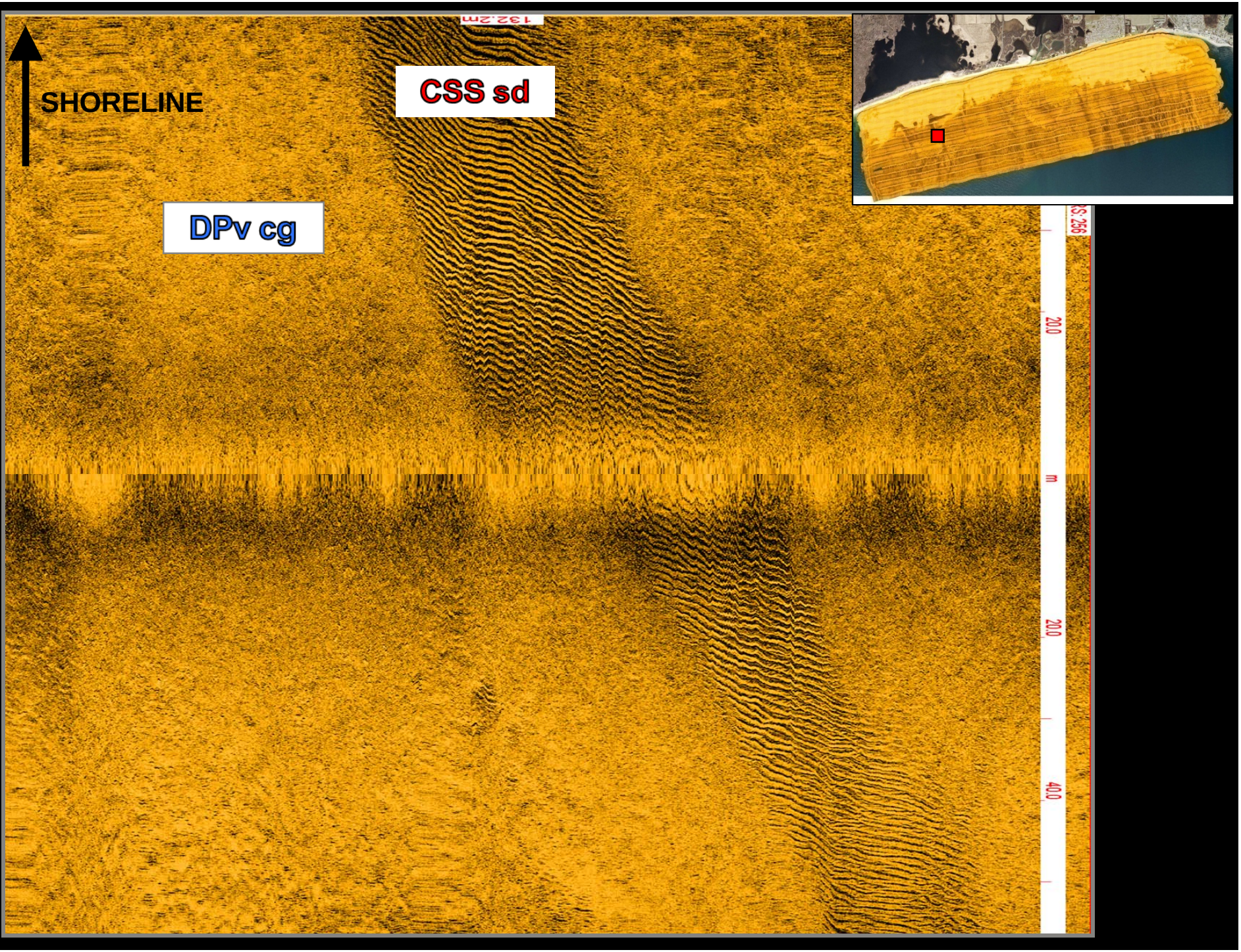
0 300 600 m 0 1,000 2,000 ft



FINAL: 30 SEPT, 2006

RHODE ISLAND GEOLOGICAL SURVEY
US Army Corps of Engineers
New England District
CRMC Coastal Resources Management Council
RIGIS
Sea Grant Rhode Island


SHORELINE
DP ss
CSS sd
40.0
20.0
m
20.0
40.0
126.2m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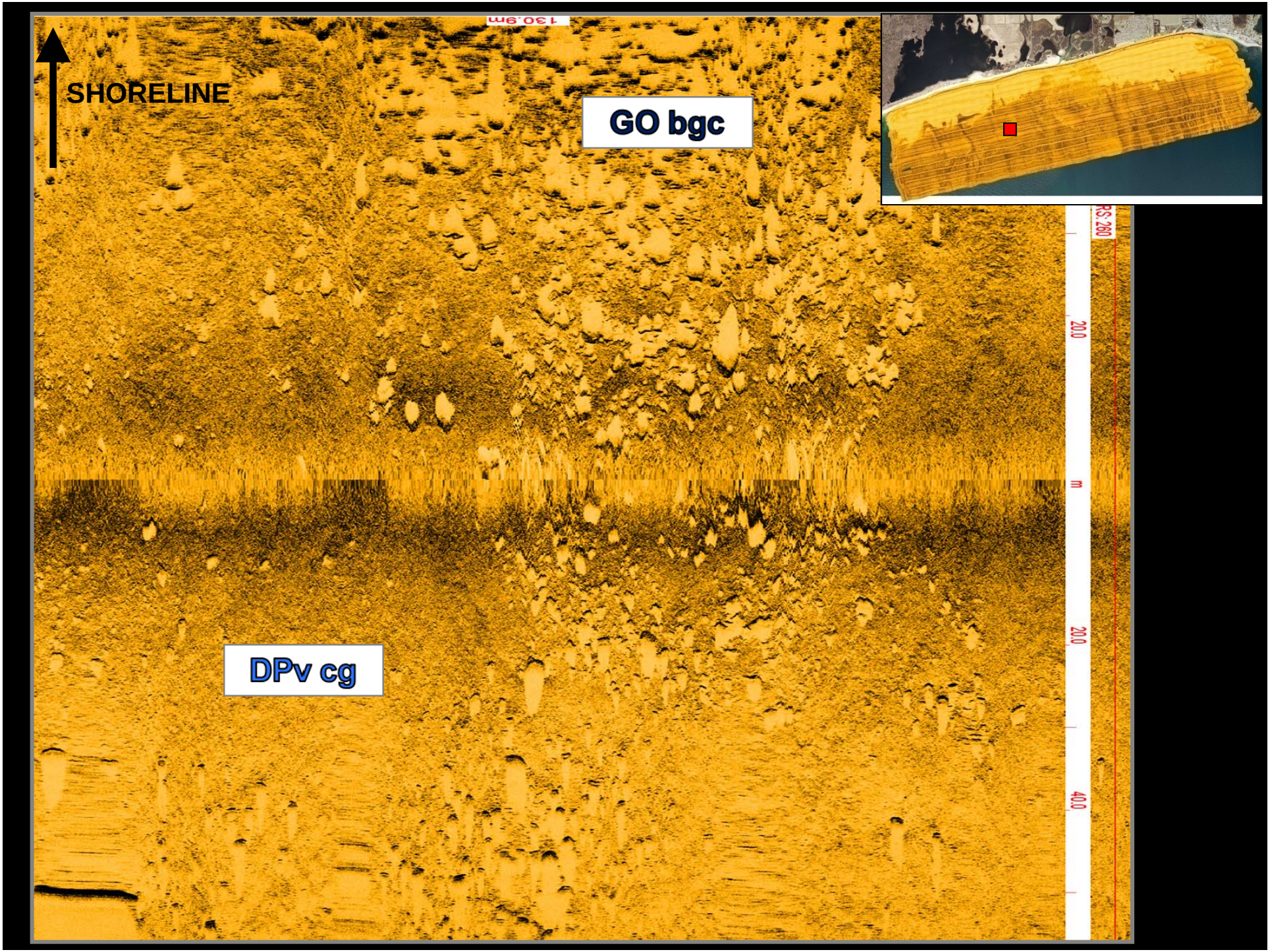
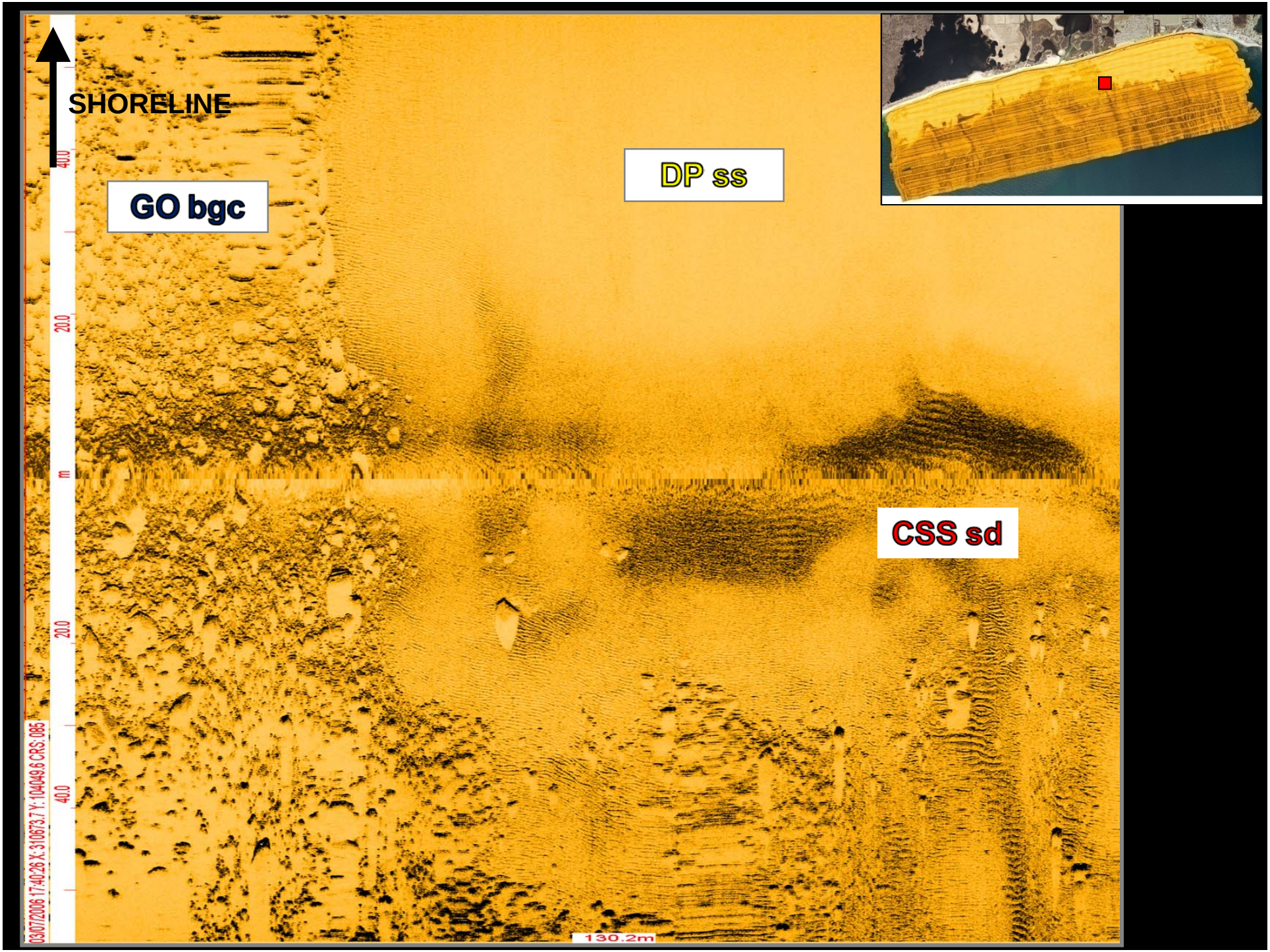
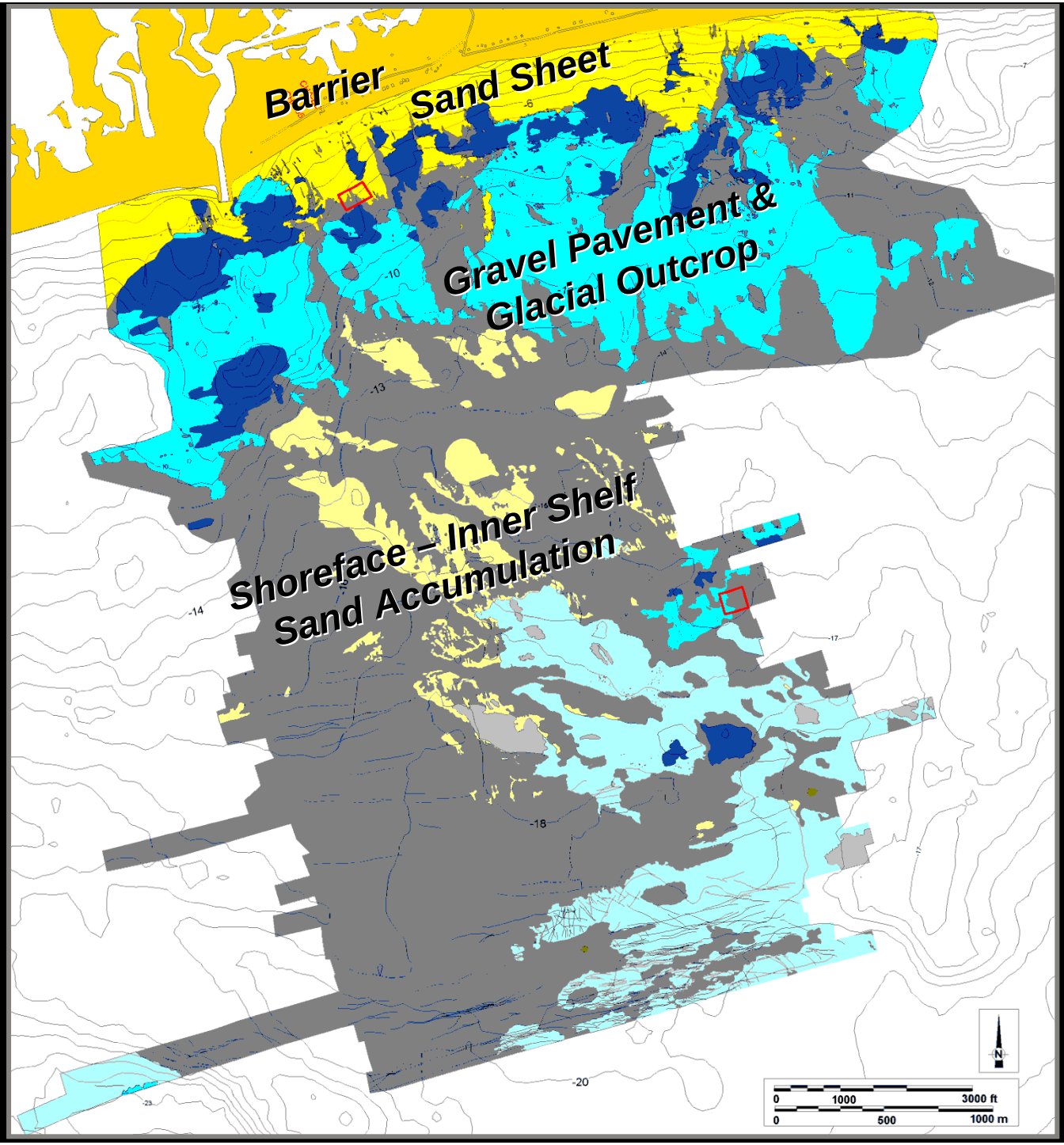
DPv cg
20.0
m
20.0
40.0


SHORELINE
GO bgc
DPv cg
20.0
m
20.0
40.0


SHORELINE
GO bgc
DP ss
CSS sd
40.0
20.0
m
20.0
40.0
03/07/2006 17:40:26 X: 310673.7 Y: 104049.6 CRS: 085
130.2m

Shoreface – Inner Shelf Deposition

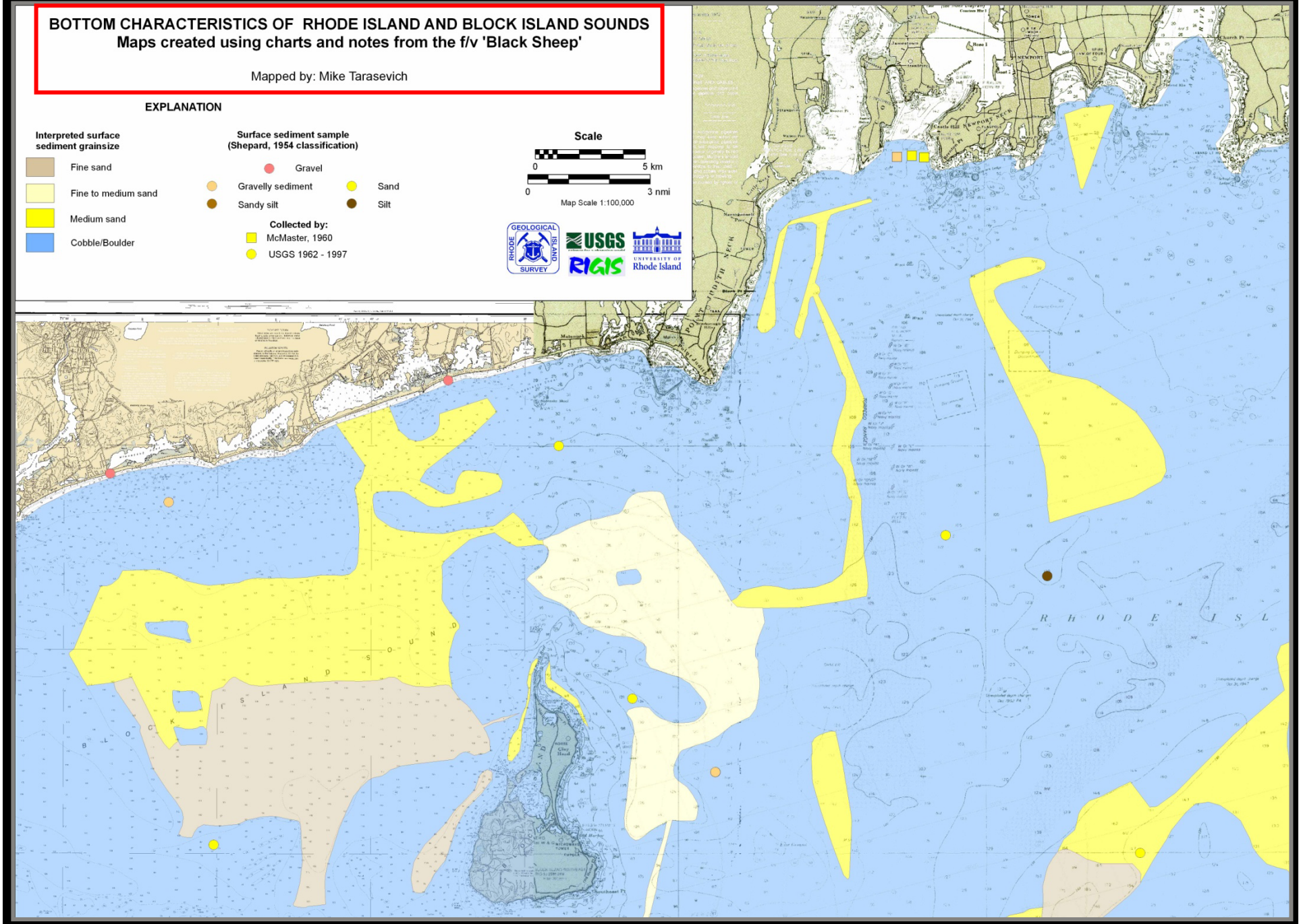
Block Island Sound



BOTTOM CHARACTERISTICS OF RHODE ISLAND AND BLOCK ISLAND SOUNDS

Maps created using charts and notes from the f/v 'Black Sheep'

Mapped by: Mike Tarasevich



BOTTOM CHARACTERISTICS OF RHODE ISLAND AND BLOCK ISLAND SOUNDS
Maps created using charts and notes from the f/v 'Black Sheep'

Mapped by: Mike Tarasevich

EXPLANATION

Interpreted surface sediment grainsize

- Fine sand
- Fine to medium sand
- Medium sand
- Cobble/Boulder

Surface sediment sample (Shepard, 1954 classification)

- Gravel
- Gravelly sediment
- Sandy silt
- Sand
- Silt

Collected by:

- McMaster, 1960
- USGS 1962 - 1997

Scale

0 5 km

0 3 nmi

Map Scale 1:100,000

GEOLOGICAL SURVEY RHODE ISLAND · USGS · RIGIS · UNIVERSITY OF Rhode Island

RHODE ISLAND SOUND

BLOCK ISLAND SOUND

POINT JUDITH TO MONTAUK POINT

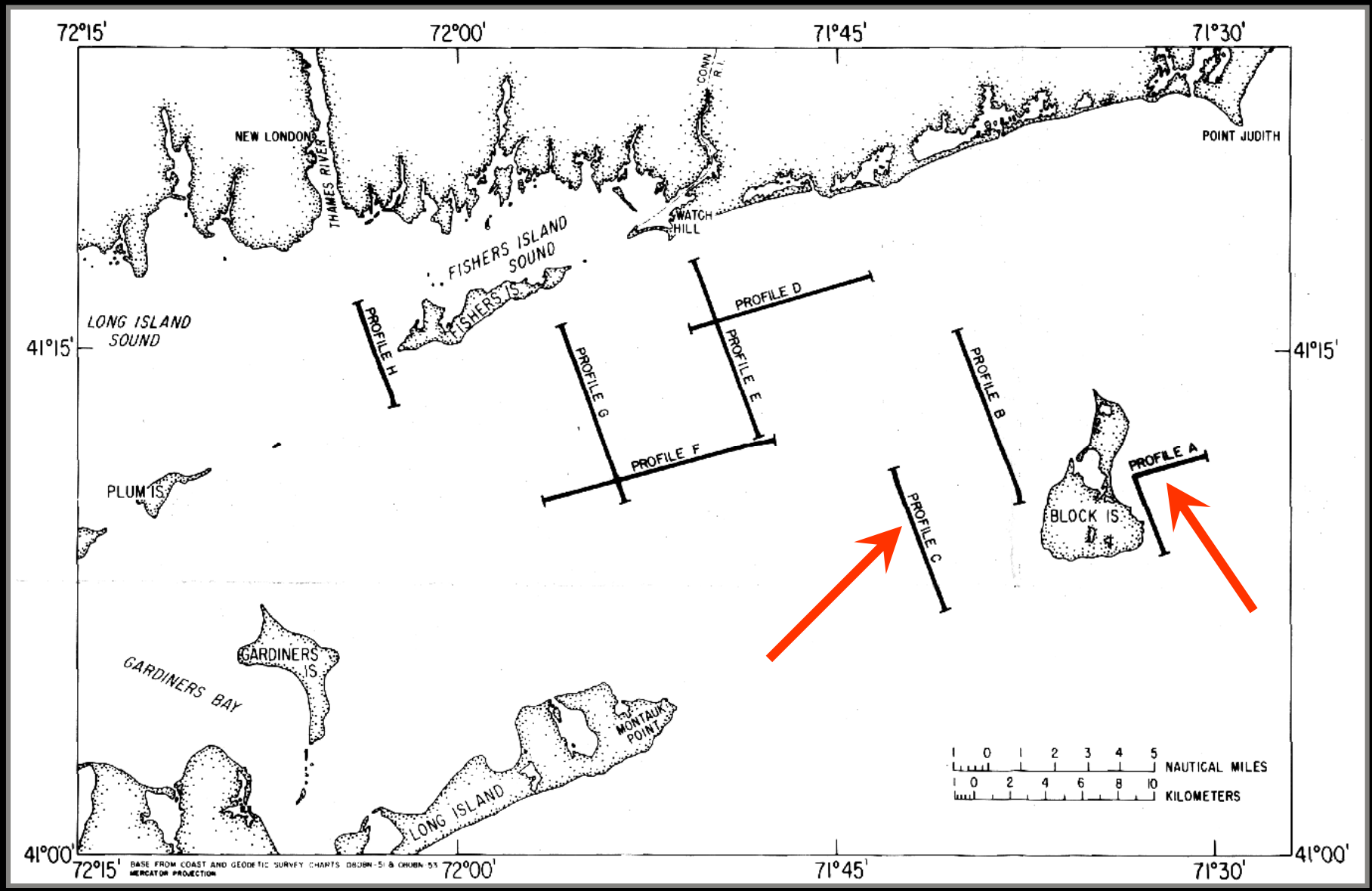
Notes:
1. Surface sediment samples were down
(USGS Open file report 00-358, availabl

Additional samples were reported in:
McMaster, 1960, Sediments of Narragan
Journal of Sedimentary Research, v. 30,

2. Originally mapped by Mike Tarasevich
Digital cartography was completed by B
Some reinterpretation by Oakley was ne

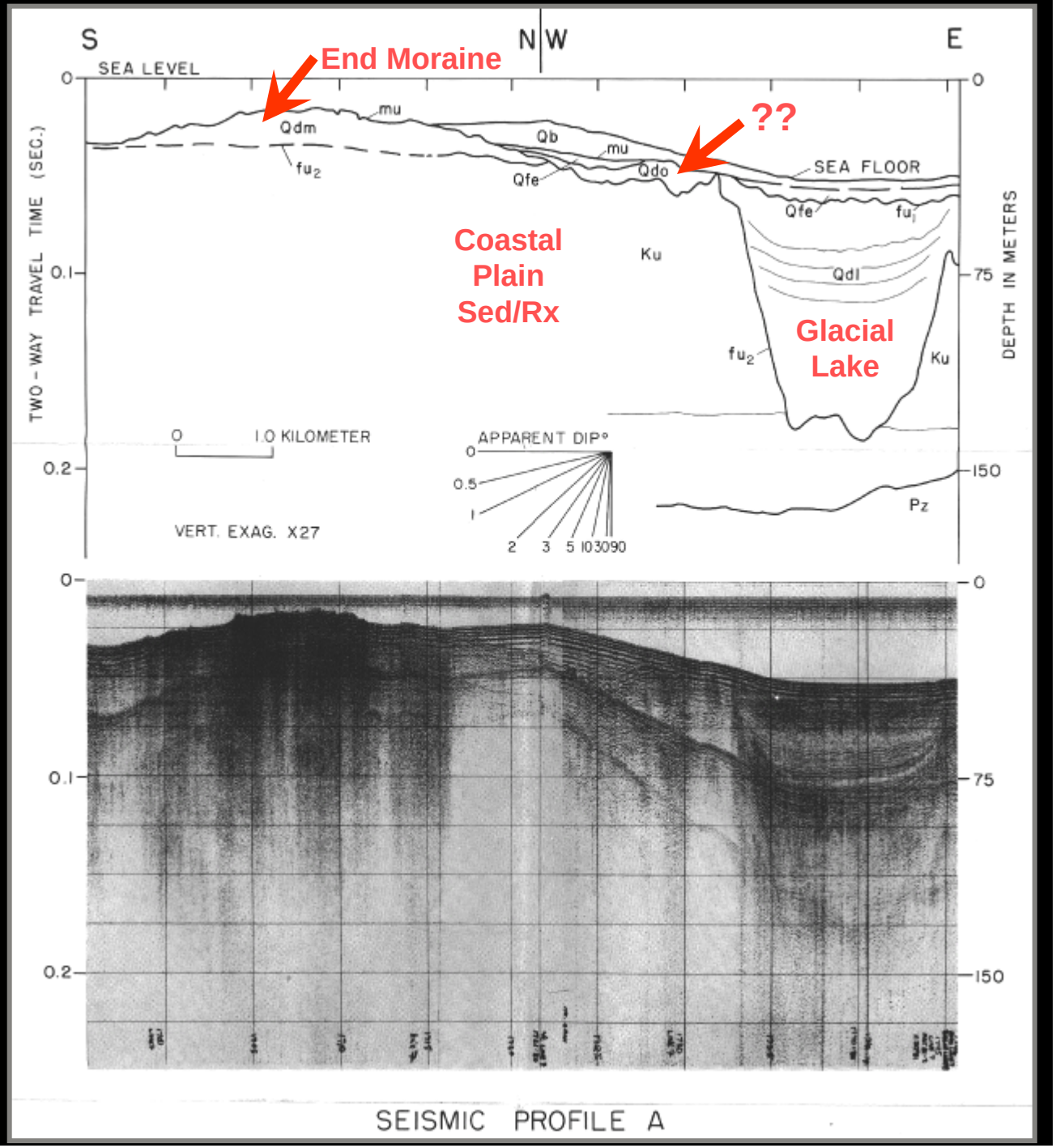
13215

USGS Seismic Profiles – Block Island Sound



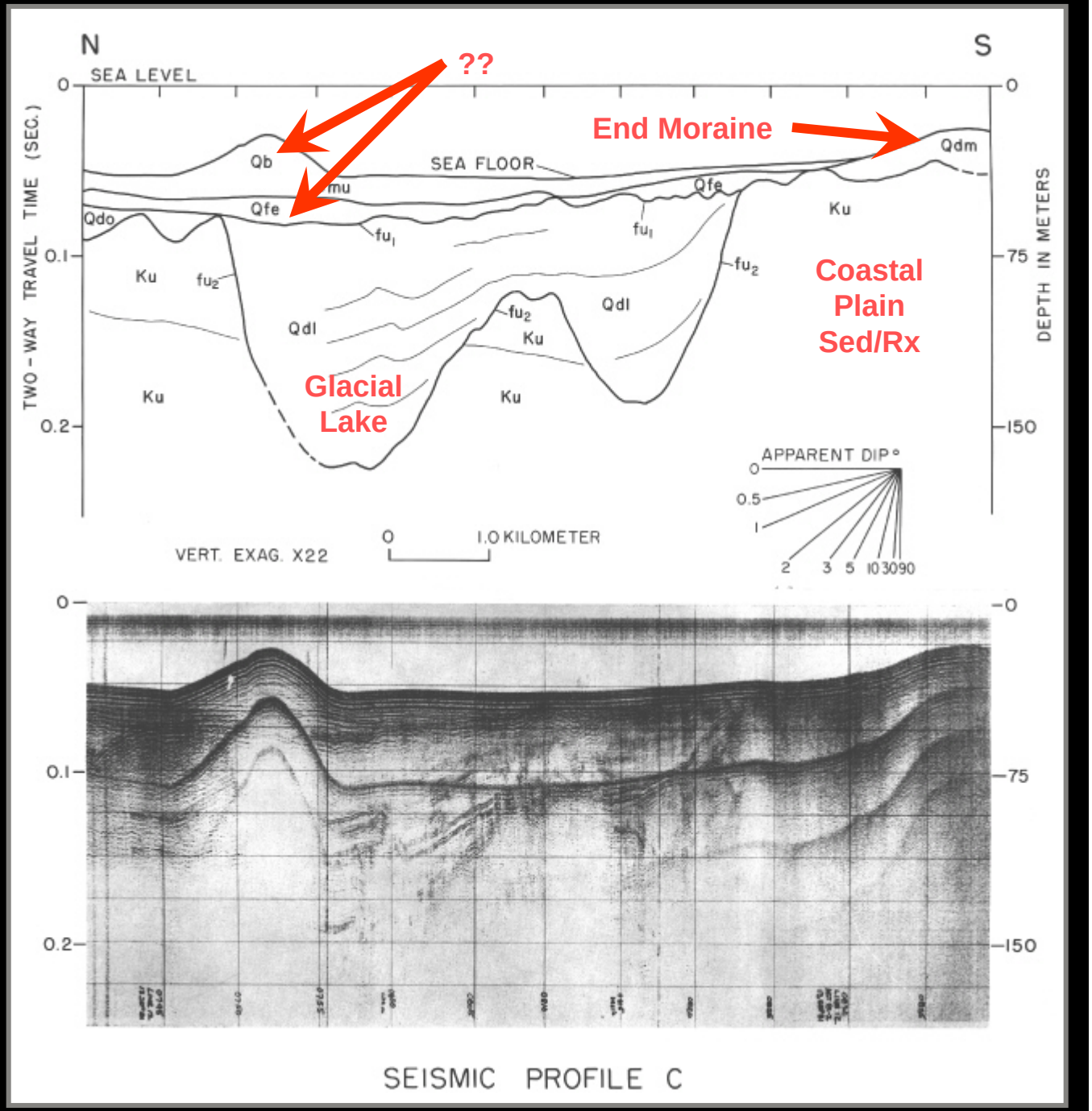
Needell and Lewis, 1984

USGS Seismic Profiles Block Island Sound

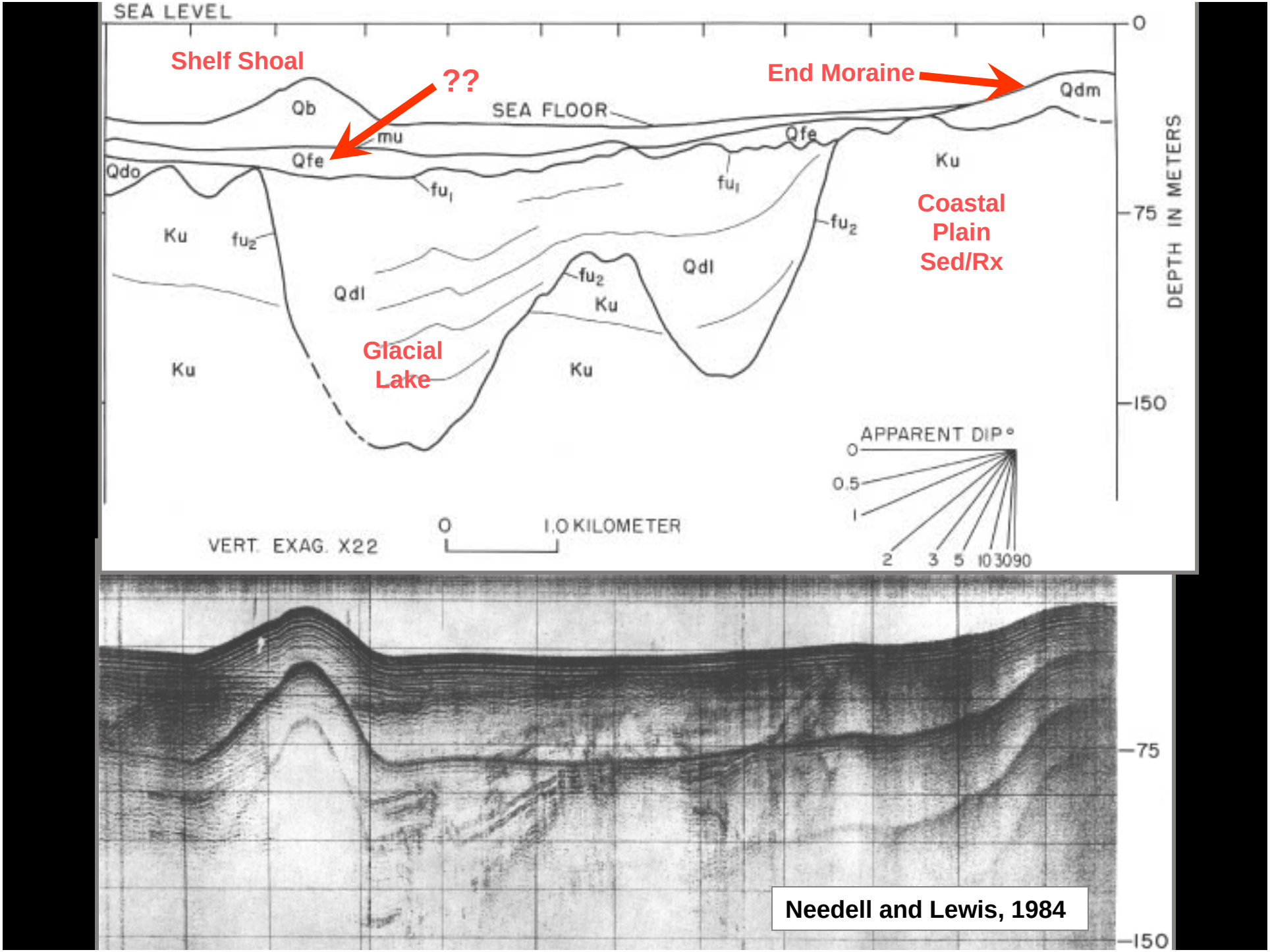


Needell and Lewis, 1984

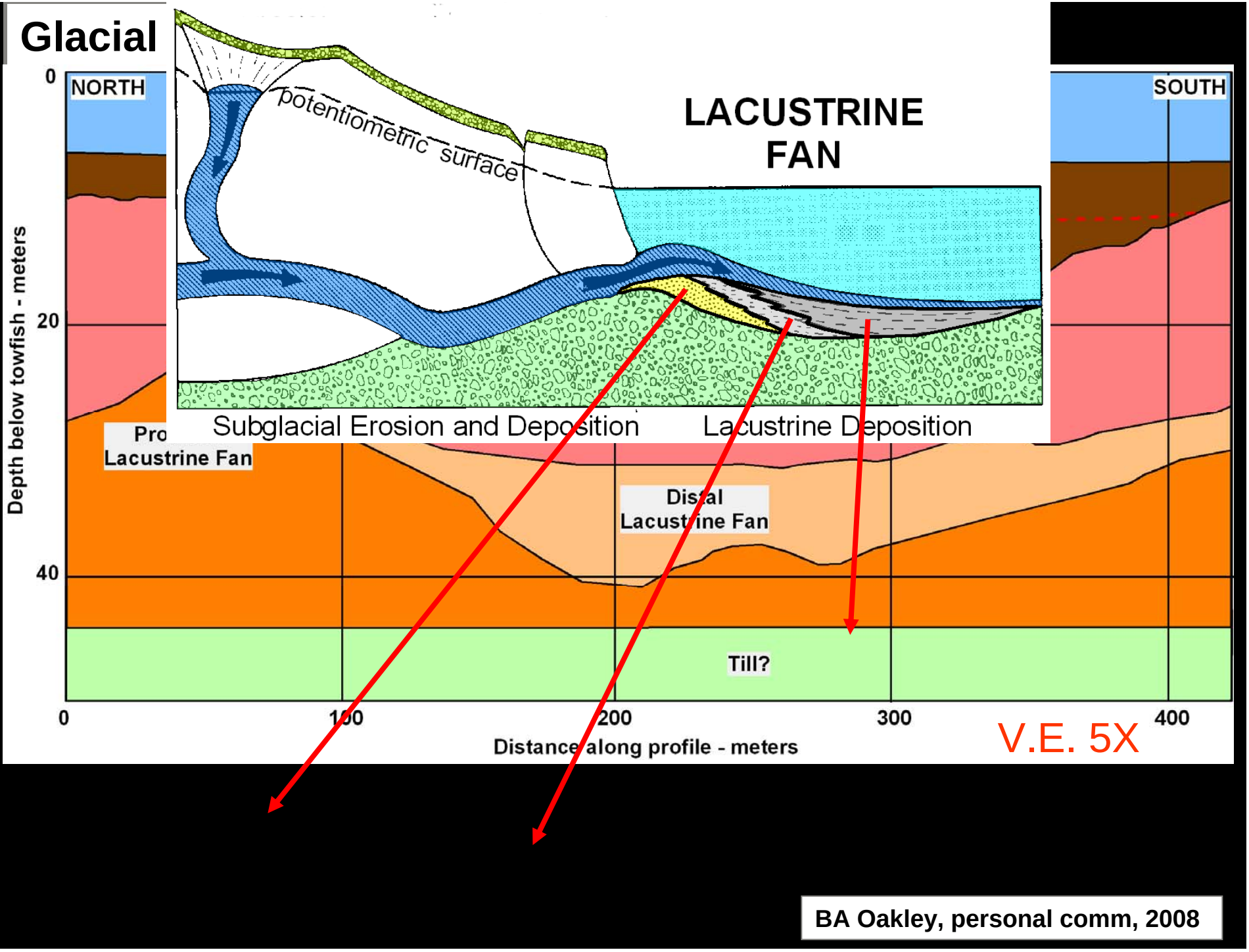
USGS Seismic Profiles Block Island Sound



Needell and Lewis, 1984


SEA LEVEL
Shelf Shoal
??
End Moraine
Qb
SEA FLOOR
Qdm
mu
Qfe
Qdo
Ku
fu1
fu2
Qdl
Coastal
Plain
Sed/Rx
Glacial
Lake
0
75
150
DEPTH IN METERS
APPARENT DIP°
0
0.5
1
2
3
5
10
30
90
VERT. EXAG. X22
0
1.0 KILOMETER
Needell and Lewis, 1984

Glacial



BA Oakley, personal comm, 2008

Summary

- **Complex Glacial Topography – End Moraines**
  Deltas and Fans
  Large Lakes

- **Topography Reshaped by Waves and Tidal Current Flow during Sea-Level Rise**

- **Present Processes – Wave Orbital Motion**
  Downwelling Flow
  Upwelling Flow
  } **Combined Flow**

  Tidal Current Flow

End of Presentation